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MISSOURI BOTANICAL
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THIRTY-SIX
BROAD-LEAVED EVERGREENS
FOR THE
CENTRAL MIDWEST

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VOLUME XLV FEBRUARY, 1957 NUMBER 1

MISSOURI BOTANICAL GARDEN
1889

THIRTY-SIX BROAD-LEAVED EVERGREENS FOR THE CENTRAL MIDWEST[1]

FREDERICK G. MEYER AND EDGAR DENISON[2]

TODAY, more and more evergreens are being grown for their year-round appeal. In the Midwest, where few evergreens are indigenous, this trend is all the more understandable. There is an increasing demand for dwarf shrubs and small trees that will fit into the scheme of small modern gardens, and that will harmonize with today's small homes and low ranch-houses. The broad-leaved evergreen trees, shrubs and ground-covers are well adapted to these needs. Their use can also greatly improve old gardens as replacements for overgrown deciduous shrubs, which are not only difficult to maintain but frequently are out of proportion to the many architectural embellishments of older houses.

Woody evergreen plants fall into two groups: the *conifers*, cone-bearing plants with needle-like leaves (pines, spruces, junipers); and the *broad-leaved evergreens*, an extremely diverse group of woody flowering plants, related in most instances only by having leaves that remain green throughout the year—American Holly, Mahonia, and boxwood, for example. For convenience, the broad-leaved evergreens will be referred to subsequently as "broadleafs".

For their esthetic appeal, the broadleafs are unexcelled among ornamental plants. Some kinds, such as holly, Mahonia, and Pyracantha, produce colorful berries; the Southern Magnolia, Pieris, Mountain Laurel, are noted for their attractive flowers. Leaves of the various kinds differ widely in size, shape, and color. The broadleafs are likewise unexcelled in their low maintenance requirements. They are tidy of habit, dropping few leaves at any one time, and they never become overgrown and weedy as do many hardy deciduous shrubs. In addition, they remain relatively free from insect attack and disease.

According to a leading St. Louis nurseryman, evergreens were little grown in our area thirty years ago. Now perhaps a hundred kinds, most of which are obtainable from local nurseries, may be grown here; and of these, thirty-five to forty are broadleafs. Although Rhododendrons and evergreen Azaleas belong to this class, they are

[1] An extensive treatment of the broad-leaved evergreens for the entire country is found in the Brooklyn Botanic Garden Handbook No. 22, *Broad-leaved Evergreens*, which can be purchased for $1.00 from the Brooklyn Botanic Garden.

[2] Mr. Denison, of Kirkwood, Missouri, artist and accomplished plantsman, made the drawings for this paper, and his excellent plant notes provided many details concerning the culture of broad-leaved evergreens. His keen plant sense and long experience in growing ornamentals in this area made his frequent council refreshing and productive.

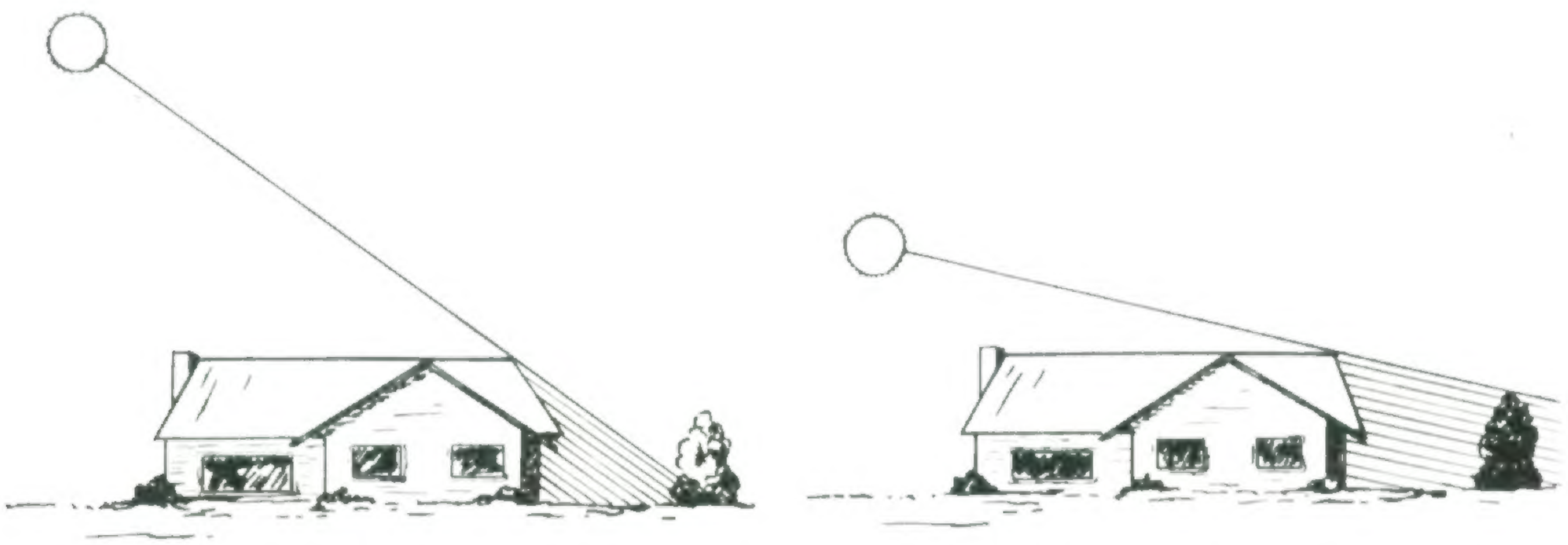
not included since they require special care and have been discussed in detail in the April, 1956 BULLETIN.

CLIMATE IN THE CENTRAL MIDWEST

The central Midwest, as defined for this paper, includes an area extending one hundred miles north, one hundred fifty miles east, and one hundred miles south of St. Louis, and west to Kansas City.

General: Sudden change characterizes the climate of mid-continental United States. Wide fluctuations in temperature, long drought periods, drying winds, and bright sun may occur at any season of the year. These climatic factors which account for the weather patterns in the Midwest are all too well-known to residents throughout our area. Maximum temperatures in summer, minimum winter temperatures, precipitation and atmospheric humidity are not limiting factors in themselves in growing broadleaved evergreens in our area. It is the timing of the climatic factors—temperature, precipitation, wind, solar radiation—which matter to the plant and to the plantsman. Relatively high temperatures one day followed by freezing temperatures the next, accompanied by bright sunny weather and freezing winds, are the chief limiting factors in growing broadleafs in the central Midwest.

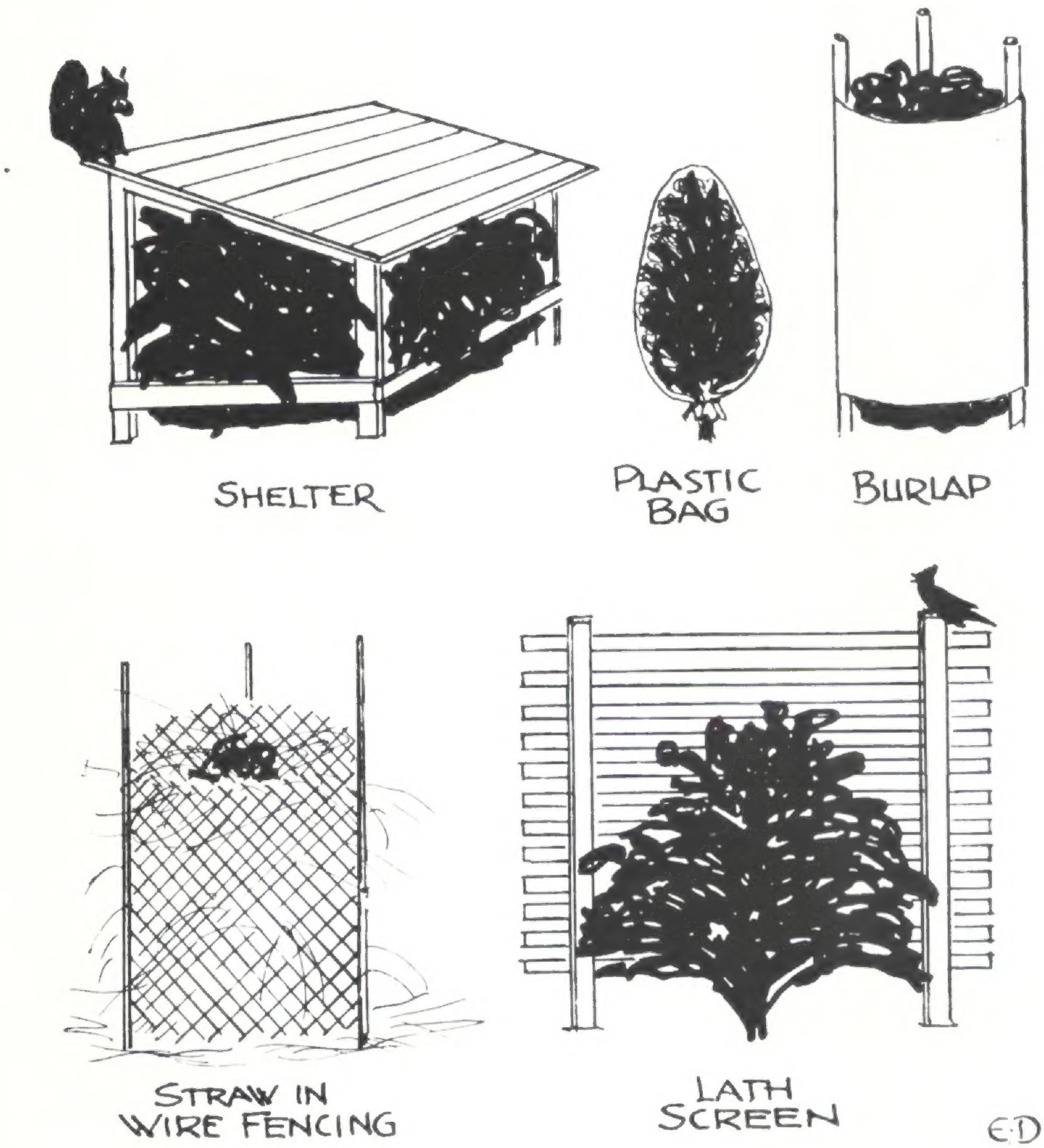
Winter: Our winters normally are characterized by long intervals of bright sun, especially during January and February, with periods of drying, freezing winds while there is little snow protection. Sudden temperature changes, sometimes with a 30–40° differential from one day to the next during the period from November to April, are common. Alternate freezing and thawing, especially towards the end of February or March, just as the plants begin to grow, inflict considerable damage some years. Likewise, an early freeze in November often does more damage to broadleafs than 20° below zero in January. In fact, many plants may be relatively unharmed by continuous freezing yet will succumb to sudden temperature changes. It is largely due to alternate freezing and thawing that camellias and some other kinds of broadleafs may not be successfully grown in our area. *Sun-scald* may inflict much damage by causing



Broadleafs not sun-resistant can be placed on north side of house for half shade during summer and full shade in winter when sun is low. From Brooklyn Botanic Garden.

the leaves to turn brown, and the plants to defoliate. Broadleafs which are exposed to sun while the ground is frozen or when the humidity remains relatively low—frequently around 20 per cent in January and February—will sunscald if the water intake from the soil is insufficient to offset transpiration. This condition is accelerated by dry north and west winds. Most broadleafs considered to be hardy here will not tolerate full sun but require protection of some sort. One should know whether the kinds in question tolerate full sun, partial shade or full shade.

Providing the correct micro-climate should be the initial consideration before attempting to plant broadleafs. Most kinds grown here require protection of hedges, trees, buildings, walls, and shelter sheds, especially in winter. The shade of a tree would provide the correct micro-climate for growing ivy, or the shaded north side of a building would provide the required micro-



Various methods for protecting young broad-leaved evergreens from winter sun-scald. Upper left drawing after Brooklyn Botanic Garden.

climate for Leucothoë, Pachysandra and other kinds requiring full shade.

Well-established plants may be expected to withstand the rigors of our climate more satisfactorily than young or newly planted ones. Aids for preventing winter damage to young plants, especially if it is difficult to provide natural protection, include: (1) the use of polyethylene bags, provided with air-holes, to completely envelope the young plants, (2) plastic wax sprayed on the foliage in late autumn to prevent excessive water loss during freezing weather (obtainable from nurserymen under several commercial names). Potassium chloride applied to the soil around the plants in September (2 pounds per 100 square feet), has been recommended, though not fully tested, for hardening-off broadleafs (favorable results have been obtained from its use on Camellias in the South and on evergreen azaleas in St. Louis). For other protection methods see illustration.

Summer: The greatest damage to broadleafs in summer occurs during periods of drought with temperatures above 90° F. and with a relative humidity of less than 30 per cent, often accompanied by hot desiccating winds from the Great Plains. However, these conditions are easier to control and cause less damage to broadleafs than wintertime conditions.

We have learned through experience which plants grown in our latitude respond favorably or unfavorably to the prevailing climatic patterns. The Common Boxwood *(Buxus sempervirens)*, *Magnolia grandiflora*, Nandina and some of the hollies probably would not thrive more than 100 miles north of St. Louis even with maximum protection. On the other hand, 60 miles south of St. Louis, these same plants grow with almost complete abandon.

Most of the broadleafs are immigrants to our gardens from China, Japan or parts of Europe, although several kinds are indigenous to the southeastern United States. The American Holly occurs in southeastern Missouri and is the only indigenous broadleaf shrub of the state. For this reason it thrives in most parts of the central Midwest in full sun.

CULTURAL METHODS

Soil: Soil conditions for growing broadleafs in our area range from bad to excellent. In some areas with poorly drained clay soil, considerable improvement in tilth would be essential. Most kinds require a well-drained soil with a relatively high (40–50 per cent) organic component for most vigorous growth. Leaf mold and peat moss are easily obtained sources of organic material. Especially do broadleafs like nitrogen, since these plants are grown principally for their leaves. The yellowing of hollies and other broadleafs may be overcome by adding to the soil additional quantities of organic matter and a relatively high nitrogen fertilizer. A 10–10–10, N–P–K commercial fertilizer is acceptable. Most broadleafs grow best in soil somewhat acid to neutral (pH 5.0–7.0. Soil of pH 7 is neutral; pH values above 7 indicate alkaline soil and values below 7 indicate acid soil.

Broadleaf shrubs may be planted near deep-rooted hardwoods, such as oaks, hard maples, hickories, and sweetgums; they should not be planted near soft-maples, elms, sycamores, poplars, willows or other trees with masses of surface roots which will compete for water. A few of the ground-covers, especially ivy and Vinca, may be planted under soft-maples or elms with complete success.

Planting Broadleafs: First excavate to two feet deep and three times the width of the plant (discard all heavy clay). Refill the hole with a mixture of 1 part sand, 2 parts organic material (leaf mold, peat moss or garden compost) and 3 parts top soil. Mix in ¼ cup ammonium sulfate per bushel of soil. Plant in soil that does not waterlog. For best drainage a raised location should be chosen, or prepare a bed 6 inches above ground level.

Mulching: Broadleafs usually require more water than deciduous shrubs. Mulches act as insulators. They help to maintain lower soil temperatures in summer, prevent deep freezing of soil in winter, and greatly reduce evaporation of water from soil surface. An organic mulch, 3–4 inches deep, of sawdust, wood chips, pecan shells, buckwheat hulls or leafmold may be used. All of these recommended materials, with the exception of leafmold, are low in cellulose and will require 2 pounds of ammonium sulfate to each bushel of mulch to prevent nitrogen starvation of the plant during decay of the mulch.

Transplanting: Since most of the broadleafs have fleshy roots, transplanting of field-grown stock is best accomplished just prior to the growing season in spring. Balled and burlaped material is preferred over bare-root stock. Plants grown in tin cans usually may be transplanted at all seasons.

Propagation: The accelerated interest in broad-leaved evergreens may be attributed, partly at least, to several recent advances in propagating techniques. The use of mist propagation and improved methods of grafting have been largely responsible for the increased popularity in growing the named forms of American Holly. Other broadleafs, formerly uncommon and difficult to propagate, now have become common. Propagation under polyethylene plastic tents has also become a highly successful method.

Maintenance and Disease: Home-gardeners today favor kinds of ornamental shrubs which require less maintenance than do most deciduous kinds, such as privet, forsythia, mock-orange, etc. The broadleafs possess all their virtues and few of the undesirable traits. Some of the hollies develop into more shapely plants when given a yearly pruning, cutting back four to five inches of tip growth; but hardly ever is it necessary to keep broadleafs within bounds in the same way as for most deciduous shrubs.

The broadleafs, in general, are remarkably free from insect pests and fungus attacks. The American Holly, Japanese Pieris, Vinca, and Ivy are the only broadleafs grown in our area known to be occasionally attacked by insects or fungus infections.

1. *Bignonia capreolata* (Trumpet Vine Family). 5–6 inches. CROSS VINE
Introduced to Gardens, 1864. Southeastern United States

A climbing evergreen with orange-red, trumpet flowers 1–2″ long, and lustrous, paired leaves that are oriented on the stem in the form of a cross. It is completely hardy in either sun or shade, although the leaves may turn bronze-green in winter. Vigorous plants may grow a foot a year, yet they maintain a neat, attractive habit without becoming excessively rampant. It grows in well-drained neutral soil and is useful on steep slopes, as well as on trellises or trees. A little-known plant in cultivation.

2. *Euonymus fortunei* (Spindle-Tree Family). 12 inches.
PURPLE-LEAF WINTER-CREEPER
Introduced to gardens, ca. 1865. China

This common evergreen ground-cover grows vigorously in a wide variety of soil types, in either sun or shade. It will thrive, even with neglect, although after several years a mass planting takes on a disheveled appearance,

due to the scraggly growth habit. In winter sunlight, the leaves turn bronze-green. Good for sunny banks. Scale insects attack this plant but they can be controlled with "Malathion".

3. *Hedera helix* (Ginseng Family). 4–5 inches. COMMON IVY
Cultivated since ancient times. Europe

The Common Ivy ranks first among the useful, reliable, and rapid-growing broadleaf ground-covers for our area. Its habit of climbing over walls and on trees gives it a special place in our gardens. Cuttings 4–6 inches long, taken in May and inserted directly into the soil for half their length and a foot apart, will root quickly and develop considerable growth the first season.

Variability in leaf shape of the Common Ivy.

It grows best in a soil pH 6.0–8.0. *Cultivars**—'MBG Bulgaria'. Leaves 4–5 inches wide, shallowly lobed, not prominently veined. A vigorous grower that resists winter injury, and drought; thrives best in full shade but will grow in partial to full sun. Introduced by the Missouri Botanical Garden in 1936.

Bulgarian Ivy at Missouri Botanical Garden.

*The term *cultivar* is used to denote the various forms of a plant which have arisen in cultivation. This term supercedes the term *variety*, which refers more precisely to variants of a species in the wild.

'Baltic'. Leaves 3–4 inches wide, deeply lobed; prominently veined. Growth less vigorous than 'MBG Bulgaria'.

(The English Ivy, although widely used, is not completely hardy in severe winters and is not recommended for permanent plantings in our area.)

4. *Pachysandra terminalis* (Boxwood Family). 6–8 inches. JAPANESE SPURGE
Introduced to gardens, 1882. Japan

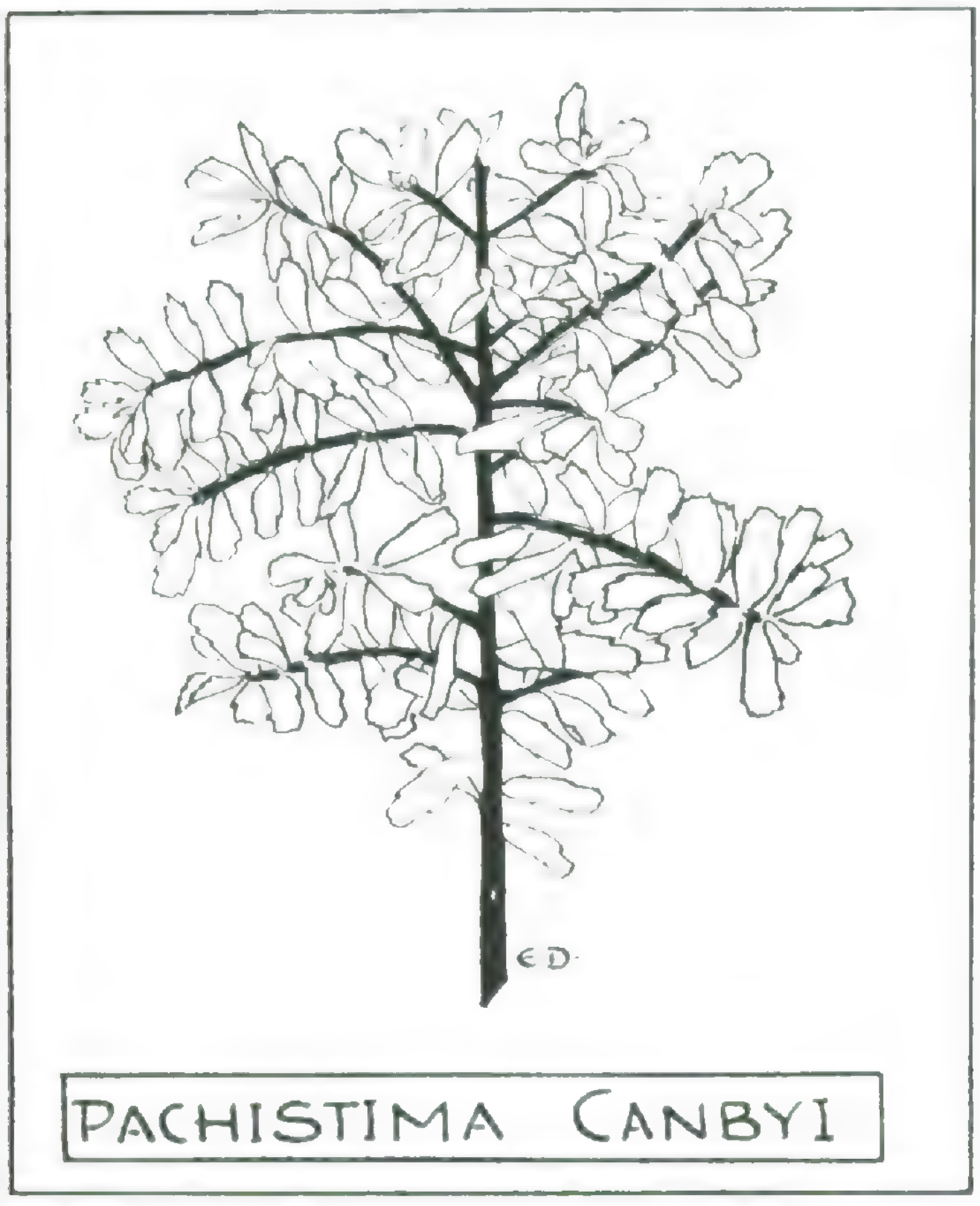
A highly esteemed low-growing, carpeting plant, with light green serrated leaves, disposed in whorls near the tips of greenish succulent stems. Small yellow-green flowers aggregated in small heads appear in the spring. A long-lived plant that spreads by rhizomes and grows more slowly than ivy or periwinkle. It should be grown in full or partial shade and in perfectly drained acid soil with a 50 per cent humus content.

PACHYSANDRA TERMINALIS

5. *Pachystima canbyi* (Euonymus Family). 12 inches.
SMOKY MOUNTAIN PACHYSTIMA
Introduced to gardens, 1880. Great Smoky Mountains

A distinctive, dwarf, spreading evergreen shrub, with wedge-shaped, dark green, and highly lustrous serrated leaves about an inch long. In winter the foliage often takes on a tarnished sheen when exposed to the sun. It grows slowly, but spreads fairly rapidly by rooting of the branches in con-

tact with the soil. This plant is fully hardy throughout our area and is reported to be grown as far north as North Dakota and Minnesota. Needs protection from sun in winter. Plant in a slightly acid soil, pH 6.0–7.0, on the north or east side of a building or under deep-rooted trees with additional protection from north and west winds.



6. *Sarcococca hookeriana* var. *humilis* (Boxwood Family). 12 inches.

CHINESE DWARF BOX

China

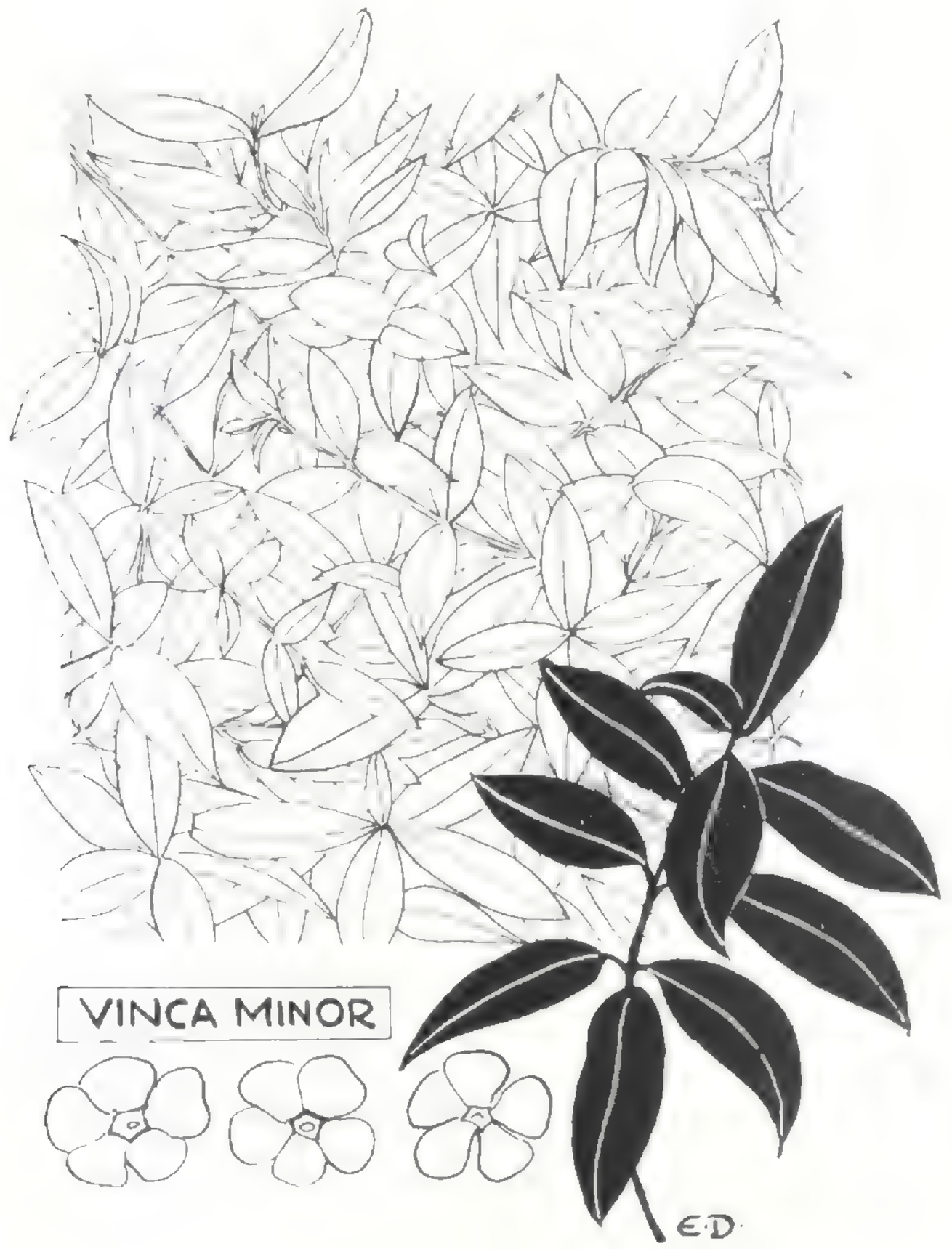
Introduced to gardens, ca. 1907.

An interesting dwarf, densely tufted shrublet with narrow, glossy, lance-shaped leaves that remain fully evergreen the entire year. The inconspicuous greenish white flowers reminiscent of boxwood are borne in the leaf axils in earliest spring. The plants are relatively slow-growing at first, but reach maturity in 4–5 years. They should be grown in full shade to prevent winter sun-scald. The north side of a dwelling or in the lee of a hedge or wall are suggested locations. This plant, although promising, has not yet been fully tested for hardiness in our area. Does best in well-drained neutral or slightly alkaline soil with a 50 per cent organic content. One of the newer broadleaf introductions.

7. *Vinca minor* (Oleander Family). 4–5 inches. MYRTLE, PERIWINKLE
Cultivated since ancient times. Europe

A very reliable old-favorite ground-cover which will grow under a wide variety of conditions. The dark green, glossy leaves, about an inch long, are borne on weak, reclining stems which quickly take root in contact with the soil, spreading the plant in all directions. In April and May, the erect new growth and small blue-violet flowers, about one-half inch in diameter, contribute a vernal freshness not associated with some other broadleaf ground-covers. Iron-clad for hardiness throughout our area, the Myrtle does best in full shade, in well-drained neutral soil with a relatively high organic content. The leaves often burn rather severely in full sun during hot, dry summers.

Cultivars—'Bowles' produces blue flowers larger than those of the common type. White and purple-flowered forms sometimes are grown.



SHRUBS

SPECIAL USES OF BROADLEAF SHRUBS

	Hedges to 8 ft.	Hedges over 8 ft.	Fruits	Flowers
Berberis julianae	×			
Bignonia capreolata				Red-orange
Buxus microphylla var. *koreana*	×			
Buxus sempervirens	×			
Elaeagnus pungens		×	Silvery	White
Ilex cornuta	×		Red	
Ilex cornuta 'Burfordii'	×		Red	
Ilex crenata	×			
Ilex glabra	×			
Ilex opaca	×	×	Red	
Ilex pernyi			Red	
Ilex vomitoria	×	×	Red	
Kalmia latifolia				Pink
Leucothoë catesbaei				Creamy-white
Magnolia grandiflora				Creamy-white, 8–10″ across
Mahonia aquifolium			Blue	
Mahonia bealei			Blue	
Nandina domestica			Orange-red or yellow	
Osmanthus ilicifolius	×			
Pieris japonica				Creamy-white
Prunus caroliniana				Pinkish-white
Pyracantha coccinea		×	Orange to red	
Viburnum rhytidophyllum			Red to black	

8. *Berberis* × *chenaultii* (Barberry Family). 3–4 feet. CHENAULT BARBERRY
Known in cultivation, 1928. Garden hybrid.

A highly ornamental hybrid barberry (*B. gagnepainii* × *B. verruculosa*) similar to *B. verruculosa* in its semi-dwarf spreading habit but differing from that species in its narrower, longer (1½–2″) leaves, and longer spines. Does not object to full sun here in summer; but needs partial shade in winter to prevent sun-scald. Highly recommended.

Berberis julianae

9. *Berberis julianae* (Barberry Family). 6–8 feet. JULIANA BARBERRY
Introduced to gardens, 1900. China

Highly prized for the leathery, shiny, spine-tipped leaves and the attractive, gently arching lateral branches. Clusters of chartreuse flowers, about one-quarter of an inch in diameter, appear among the leaves during April, followed by bluish berries in late summer. Growth is rapid—plants 15–18 inches high will produce a three-foot hedge in as many years. Fully hardy, although some of the leaves may become reddish or tarnished after the first hard freeze. Drought-resistant, once established. Develops best in full sun; shade-grown plants become leggy. An excellent hedge or screening plant.
Cultivars—'Nana', a dwarf form. 'Pyramidalis', an upright form with ascending branches.

10. *Berberis sargentiana* (Barberry Family). 4–5 feet. SARGENT'S BARBERRY
Introduced to gardens, 1904. China

Similar to the Juliana Barberry but with narrower leaves. At the Missouri Botanical Garden, specimens of the Sargent's Barberry are as hardy as the Juliana Barberry, though less attractive. May be grown like the latter species.

11. *Berberis triacanthophora* (Barberry Family). 4–5 feet.

THREE-SPINED BARBERRY

Introduced to gardens, 1907. China

Closely related to *Berberis verruculosa* but differs from it in having larger, 3-spined leaves and a more upright habit. Hardy here but rarely grown. A handsome plant. Should be grown in the same way as *B. verruculosa*.

12. *Berberis verruculosa* (Barberry Family). 3–4 feet. SILVERLEAF BARBERRY

Introduced to gardens, 1904. China

A densely branched, dwarf spreading shrub, usually about as wide as high. Outstanding characteristics are the spiny leaves with waxy bloom beneath, contrasting with the lustrous green of the upper surface. In April, small yellow flowers, about one quarter of an inch in diameter, appear among the leaves along the underside of the stems, followed by clusters of small, blue, bloom-covered berries in late summer and autumn. Full sun to half shade in mid-summer with somewhat more shade in winter is recommended to prevent the leaves from burning. As a low hedge or border plant this barberry is unexcelled. Slow growing. Does best in a well-drained, slightly acid soil, pH 6.0–7.0.

13. *Buxus microphylla* var. *koreana* (Boxwood Family). 4–5 feet.

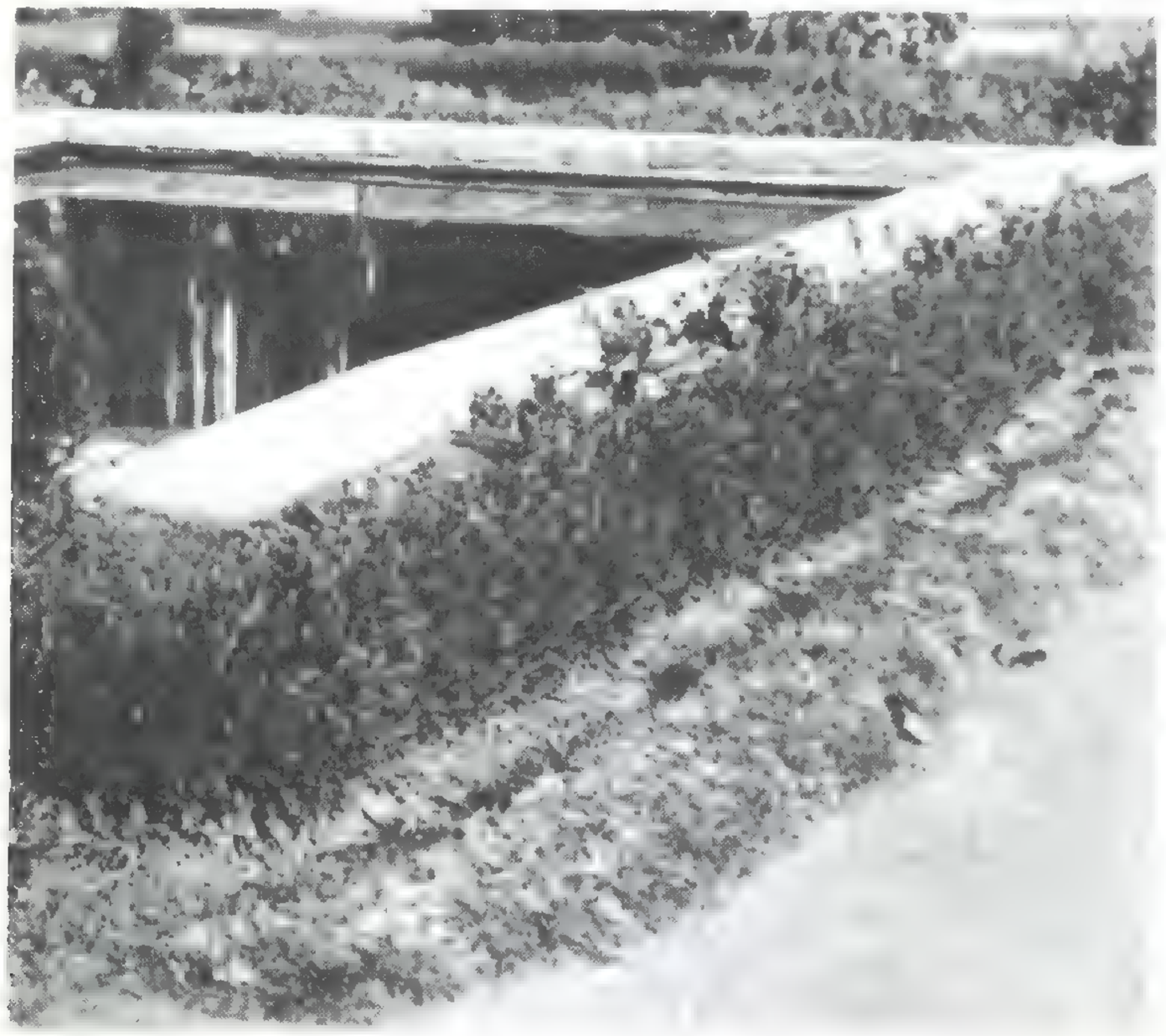
KOREAN BOXWOOD

Introduced to gardens, 1919. Korea

Reputed to be the hardiest boxwood for our area. Temperatures of 20° below zero within the past twenty years have not seriously injured the specimens at the Missouri Botanical Garden Arboretum. Vigorous young individuals will grow about 3 inches a year. Plants 20 years old should stand 5 feet high. Forms a dense, much branched globose or pyramidal shrub, hardly distinguishable from the Common Boxwood (*Buxus sempervirens*). However, unlike the Common Boxwood, the leaves of the Korean species are dull and become bronze green, especially in the winter sun. Shade-grown plants

remain greener. May be grown in full sun, without protection. Prefers a well-drained soil, with a 50 per cent organic content, pH 6.0–8.0.

Variety—sinica, from China. Of more upright growth habit, the leaves larger and more bronze in winter than var. *koreana*.



Buxus microphylla var. *koreana*

14. *Buxus sempervirens* (Boxwood Family). 10–12 feet. COMMON BOXWOOD
Known in gardens since ancient times. Europe

Highly esteemed for the small, fragrant glossy leaves and the dense globose growth habit. Pyramidal and columnar types are also grown. Despite the slow growth—about two to three inches per year—few plants we grow can offer more in reward for the patience required to produce a mature boxwood specimen. The Common Boxwood is less hardy in youth than older well-established plants and should be protected from sun and freezing winds in winter. Plant in well-drained soil; boxwood loathes wet feet, especially in winter. An occa-

sional sprinkling of agricultural lime once a year is recommended to maintain a slightly alkaline soil, pH 7.0–8.0. *Cultivars:* Some of the hardiest forms come from Washington, Missouri, where boxwood has been grown for 100 years. A form more recently introduced by the Missouri Botanical Gardens from Jugoslavia has been successfully grown in the St. Louis area over the past twenty years. Other kinds of unknown origin are grown here.

Buxus sempervirens

15. *Elaeagnus pungens* (Russian Olive Family). 10–15 feet.

EVERGREEN ELAEAGNUS

Introduced to gardens, 1830. Japan

A much-prized, densely branched, round-headed shrub, known for its attractive silvery evergreen leaves 1–2 inches long, and the fragrant white flowers borne in September to December. Golden-brown stellate hairs are dispersed like small polka-dots over the silvery ovate leaves and branches. Well-established plants are fully hardy if given the protection of surrounding

trees from freezing winds and winter sun. Does not object to full sun in summer. Young plants given additional protection will grow 8–10″ a year. Prefers a well-drained soil about neutral in reaction. A good hedge plant. *Cultivars*—'Fruitlandii'; 'Reflexa'; 'Simonii'. These forms differ in the size and shape of the leaves and in the habit of growth.

16. *Hedera helix* 'Arborescens' (Ginseng Family). 6–8 feet. SHRUB IVY

Ivy may produce two kinds of leaves, juvenile and adult, on the same plant and is thus dimorphic. As a creeping ground-cover, the plants produce only juvenile leaves year after year and will never flower. Yet, if the plants are permitted to climb on a tree trunk or wall they develop mature leaves and, eventually, flowers. Changes from juvenility to adulthood are evidenced by a transition from lobed to almost unlobed leaves, and by the development of terminal flowering branches. The many forms of ivy long grown as house plants are in the juvenile state.

Shrub Ivy plants are produced from cuttings taken directly from the mature branches. A rooted scion eventually develops into an erect ivy shrub. Cuttings taken in July, during the peak of the growing season, can be

HEDERA HELIX VAR. ARBORESCENS

rooted very successfully by the method of mist propagation. In autumn and winter, cuttings may be rooted under a plastic tent indoors. Grows well in any good garden soil, pH 6.0–8.0.

HOLLIES

Sex in hollies: With few exceptions, hollies are dioecious; that is, their flowers are of two kinds, male (staminate) and female (pistillate), which are borne on separate plants. The more common condition among flowering plants is the bisexual flower, with the male and female parts together in

Flowers of American Holly: left, female; right, male.

a single flower. In most hollies, both male and female plants are required for the production of berries, especially berries with viable seeds. But quite commonly, a small percentage of bisexual or perfect flowers occurs on female plants giving rise to berries, but with inviable seeds. A male branch may be grafted on a female specimen in lieu of having a separate male plant, although this method has met with varying degrees of success.

Ilex aquifolium 'Balkan'

17. *Ilex aquifolium* 'Balkan' (Holly Family). 20 feet. BALKAN HOLLY
Missouri Botanical Garden introduction, 1936. Southeastern Europe

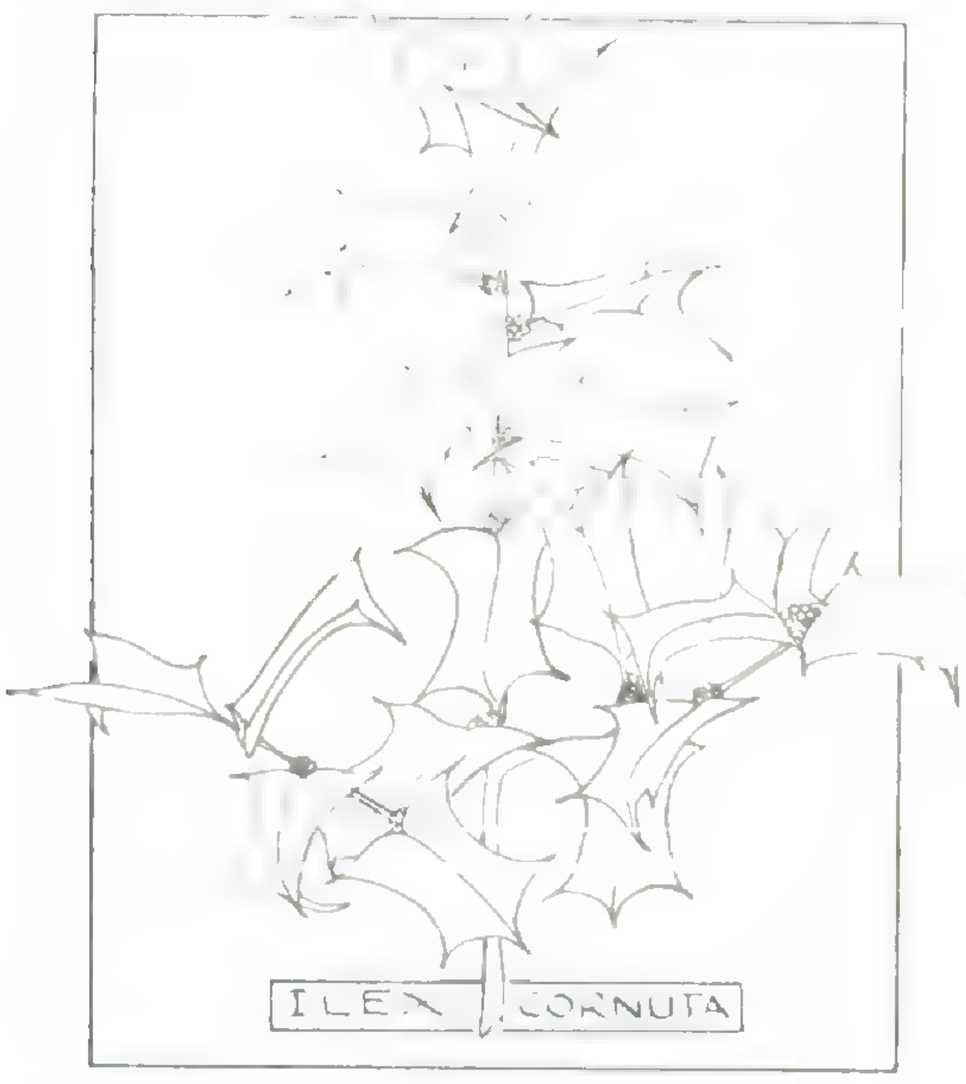
Ilex aquifolium, commonly known as the English Holly, is an extremely variable species with a wide geographical distribution, extending from Great Britain, southeastward across Europe to Asia Minor. The form occurring on the Balkan peninsula may be considered a geographical variant of the English Holly. It differs from the English form by its greater hardiness

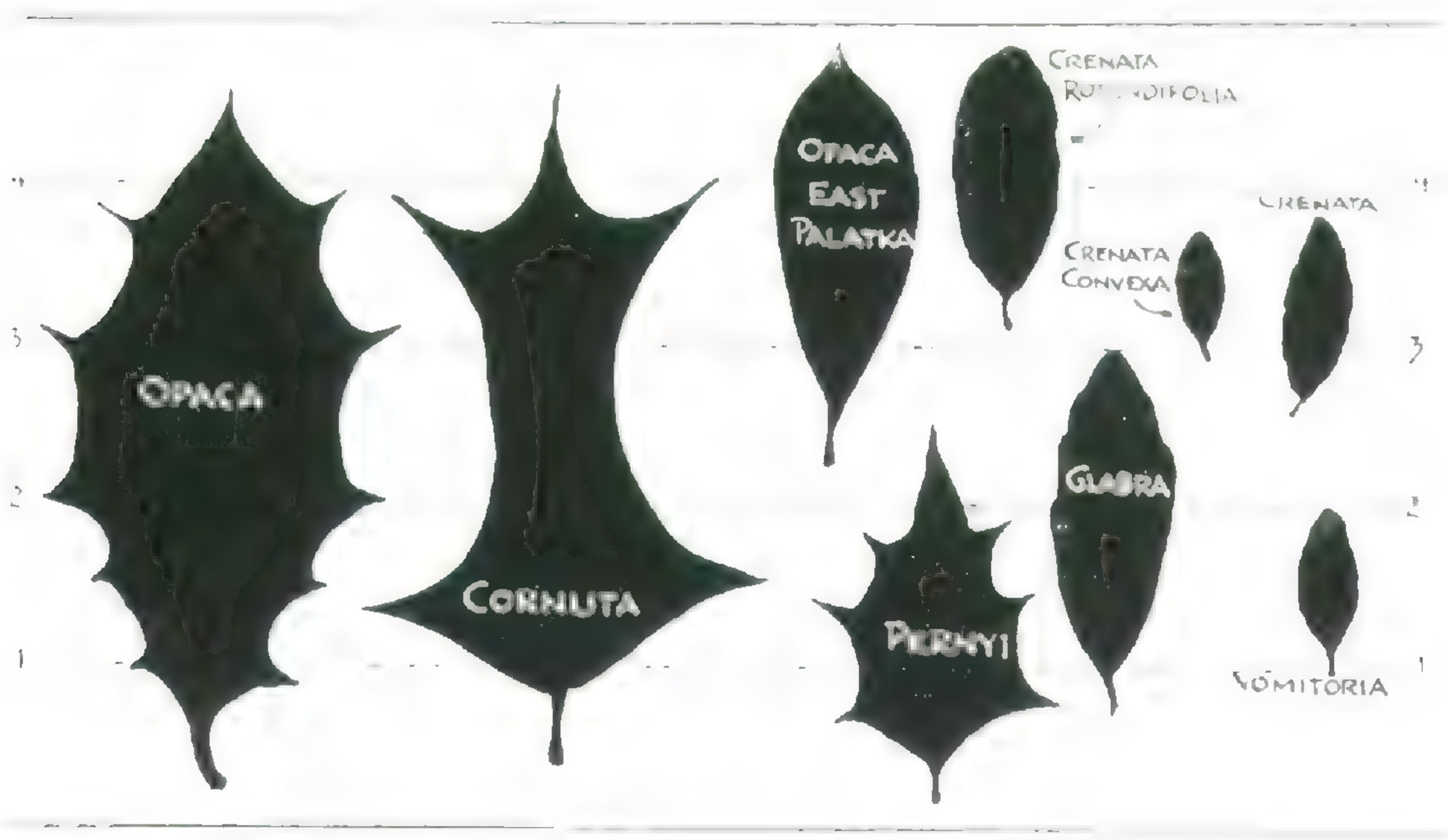
and dull leaves. In our climate, the Balkan Holly is the hardiest form of *I. aquifolium* known. Except for frost damage to late autumn-grown shoots, the specimens at the Missouri Botanical Garden have thrived for the past twenty years with only slight protection. The soil requirements are the same as for other hollies.

18. *Ilex cornuta* (Holly Family). 8–10 feet. CHINESE HORNED HOLLY
Introduced to gardens, 1846. China

One of our most interesting holly introductions. Known for its dense branching habit, lustrous, 3- to 5-spined leaves about 3 inches long. The red berries (larger than the American Holly) are borne in clusters which persist throughout the winter. Young vigorous specimens produce 8–12 inches of new growth a year in well drained soil, pH 5.0–6.5, with about a 50 per cent organic content. A well established plant (3–5 years in one location) can withstand full sun if protected from north and west winds. Young newly planted ones require shading to prevent sun-scald during January and February.

Cultivar—'Rotunda', an interesting, low spreading plant 4–5′ tall; leaves narrower and somewhat longer than the typical form.





Size relationships of holly leaves.

19. *Ilex cornuta* 'Burfordii' (Holly Family). 10 feet. BURFORD HOLLY
Known in cultivation, 1895. Garden origin

Similar in growth habit to the Chinese Horned Holly, but with very short-spined or spineless leaves. Known especially for its red berries and extremely lustrous, dark green leaves, which are convex on the upper side. This cultivar produces only bisexual flowers and therefore all plants may produce berries. As hardy as the Chinese Horned Holly and may be grown like it.

The Burford Holly, a sport of the Chinese Horned Holly, was discovered in a batch of seedlings by Thomas H. Burford, superintendent of a famous cemetery in Atlanta, Georgia. In our area, it fails to fruit regularly, although specimens of considerable age are thriving here, especially around St. Louis.

20. *Ilex crenata* (Holly Family). 2–8 feet. JAPANESE HOLLY
Introduced to gardens, 1864. Japan

Known for the wide diversity in growth habit and in leaf shape. Numerous cultivars are known, all of which make good hedge or specimen plants. The various forms are fast-growing and are easy to maintain. Grows best in well-drained soil, pH 5.0–6.5.

Cultivars — 'Rotundifolia'. Leaves ovate, pointed, 1¼ inches long, flat; plants 6–8 feet, largest of the cultivated forms. Tolerates nearly full sun in summer, but requires partial to full shade in winter. The most widely grown cultivar.

'Convexa'. Leaves ovate, without a point, about ½–1 inch long, convex on the upper surface; plants 3–4 feet with a spreading top. Needs more

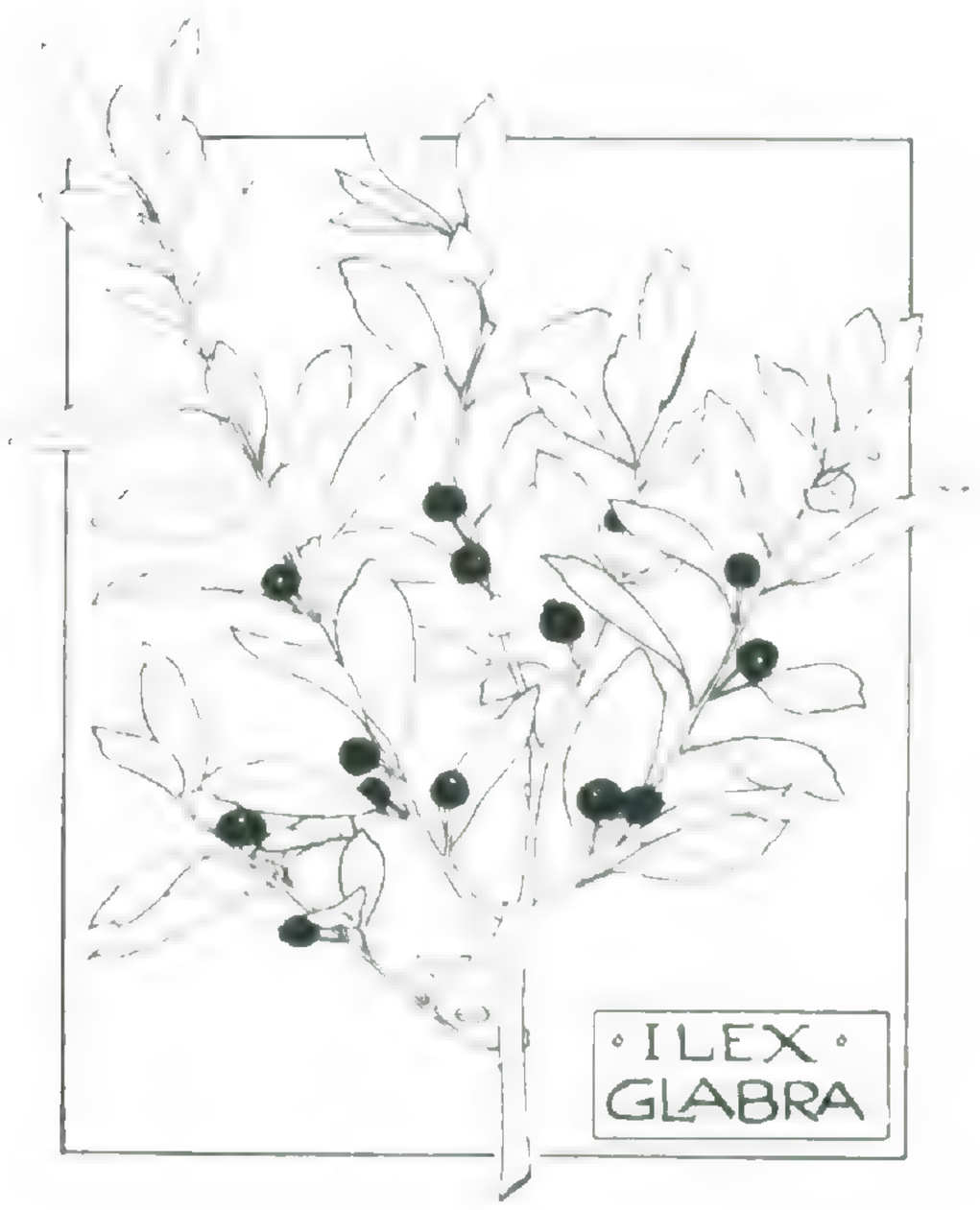
shade in summer than 'Rotundifolia'. Excellent for a low hedge.

'Helleri'. Leaves lance-shaped, about ¾–1 inch long, flat; plants dwarf, up to 2 feet. Grows best in shade. Excellent for a low hedge.

'Stokes'. Leaves lance-shaped, about ½–¾ inches long, flat; plants 3–4 feet high. Grows best in partial shade. Excellent for a low hedge. Patented form from Warren Stokes, Butler, Pa.

Several other named forms are available from nurserymen.

21. *Ilex glabra* (Holly Family). 4–6 feet. INKBERRY
Introduced to gardens, 1759. Southeastern United States



One of the black-berried native American hollies, known for the dense bushy habit, reminiscent of the Japanese Holly *(Ilex crenata)*. The leaves are about 2 inches long, blue-green and dull. Relatively unknown in gardens here, probably because the dull foliage is less attractive than the Japanese Holly and other broad-leaved evergreens with small lustrous leaves. For hardiness, the Inkberry ranks near the top of the list. Furthermore, plants are easy to establish, and growth up to 6 inches a year may be expected in young plants. Does best in a fairly acid soil, pH 4.5–6.0. Drought-resistant and does not sun-scald in winter. Excellent for hedges.

22. *Ilex opaca* (Holly Family). 20–30 feet. AMERICAN HOLLY
Introduced to gardens, 1744. Eastern United States

Known for the evergreen, spine-tipped leaves and red berries. It is the hardiest of the broad-leaved trees grown in our area. The finest specimens are produced in full sun. Fewer leaves and berries result when specimens are grown in shade and the plants tend to become somewhat leggy. In full sun the American Holly remains fully green and does not sun-scald or discolor in summer or winter. May be planted as a lawn specimen; also ideal as a hedge plant. Young seedlings grow 6–8 inches a year. Does best in acid soil, pH 5.0–6.0. The American Holly is a native of southeastern Missouri.

Cultivars—Outstanding are 'Arden', 'Clark', 'Croonenberg', 'East Palatka', 'Griscom', 'Hedgeholly', 'Hookstraw', 'Howardii', 'Manig', 'Merry Christmas', 'Old Heavy Berry', 'St. Mary'. Many others available from specialists.

Insect Pests—The leaf-miner is often

Ilex opaca

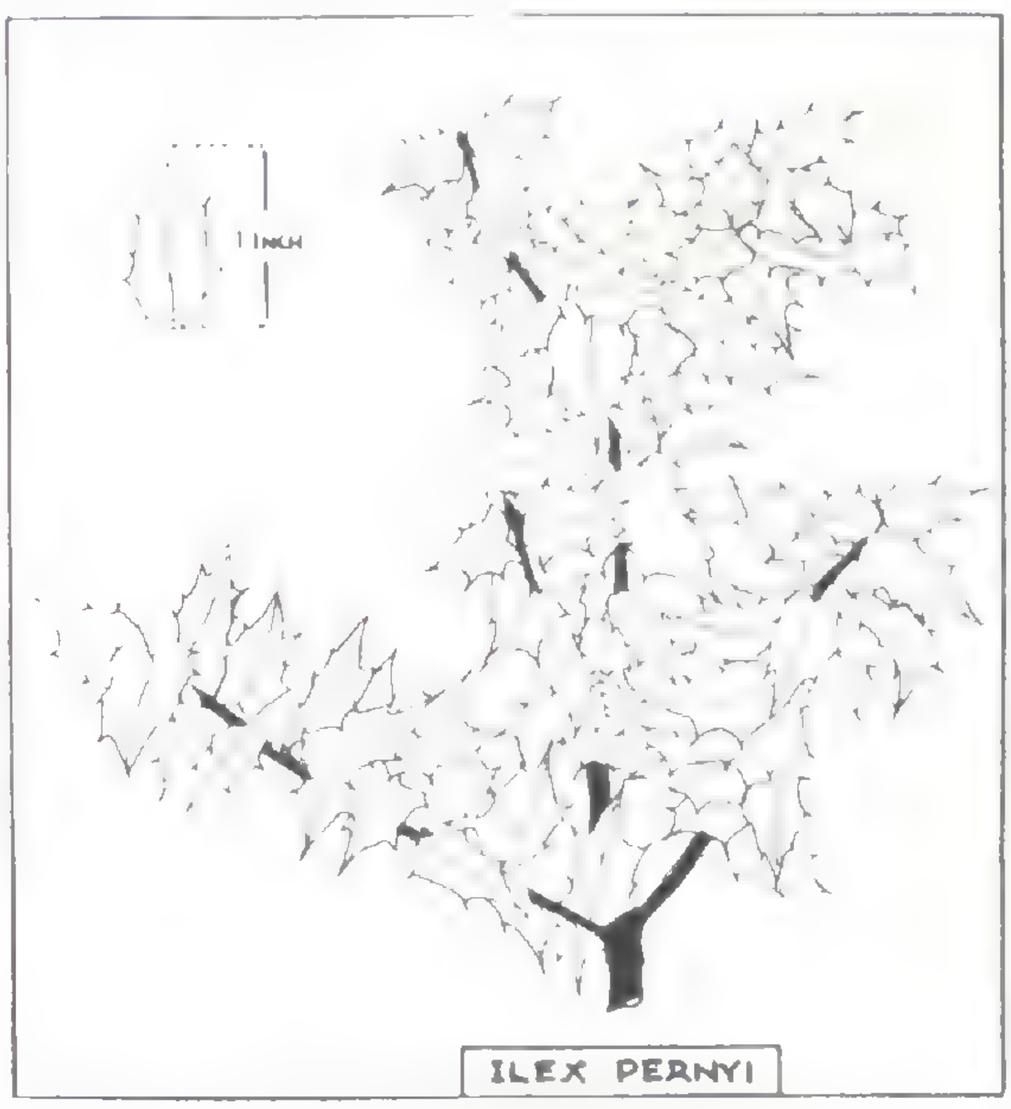
rather bad. It burrows under the epidermis of the leaf causing whitish and blistered areas. It may be controlled with an emulsion containing 25 per cent DDT, diluted 1 ounce to each 2 gallons of water; or a wettable powder containing 50 per cent actual DDT can be used at the same dilution. Spraying should begin around May 10 to May 15; two sprays, 10 days apart should be given.

23. *Ilex pernyi* (Holly Family).

8–10 feet. PERNY HOLLY

Introduced to gardens, 1900. China

Similar to the American Holly in growth habit, but with much smaller leaves, about 1–1½ inches long, lustrous and spine-tipped. They appear as if plaited on the branches. Little known, perhaps due to its slow growth; however, a well-grown specimen laden with red berries is most rewarding.



Not quite as hardy as the Chinese Horned Holly. Demands full shade in winter and half sun in summer. A site on the south side of a wall, near a high hedge or in the shadow of a dwelling with further protection by high trees will aid in preventing sun-scald to the leaves in winter. An acid, well-drained soil, pH 5.0–6.0, and high in organic matter is recommended.

24. *Ilex vomitoria* (Holly Family). 15–20 feet. YAUPON
Introduced to gardens, 1700. Southeastern United States

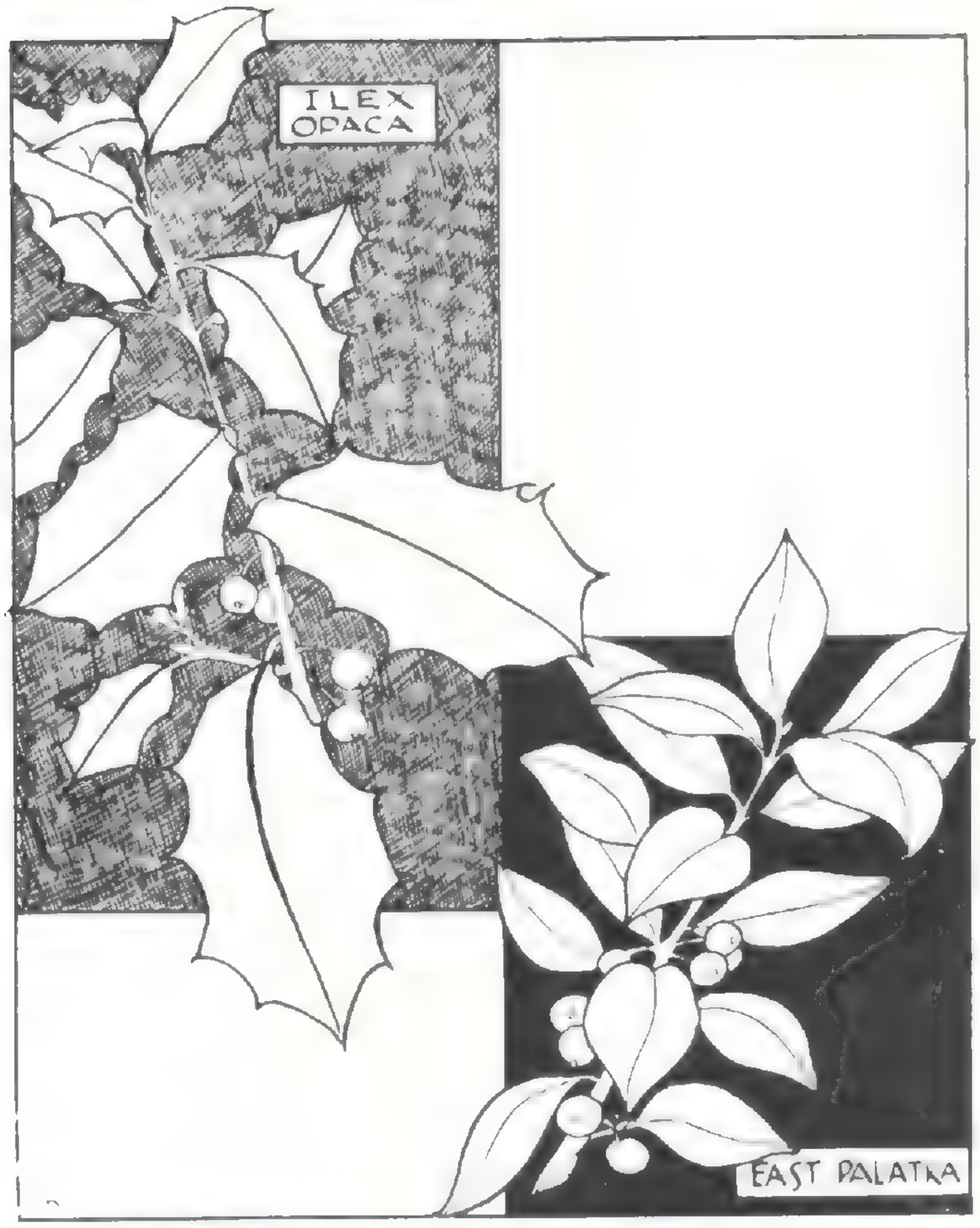
Known for the glossy, slightly serrated leaves ½–1½ inches long, the symmetrical, pyramidal growth form, and the small red berries. Although a native American species, the Yaupon is not as hardy as the American Holly. Young plants should be protected from winter sun and freezing winds. Best planted on the north side of a building or in the shade of a tall hedge or deep-rooted trees, such as oaks and hard maples. An excellent hedge plant.

25. *Kalmia latifolia* (Heath Family). 5–6 feet. MOUNTAIN LAUREL
Introduced to gardens, 1734. Southeastern United States

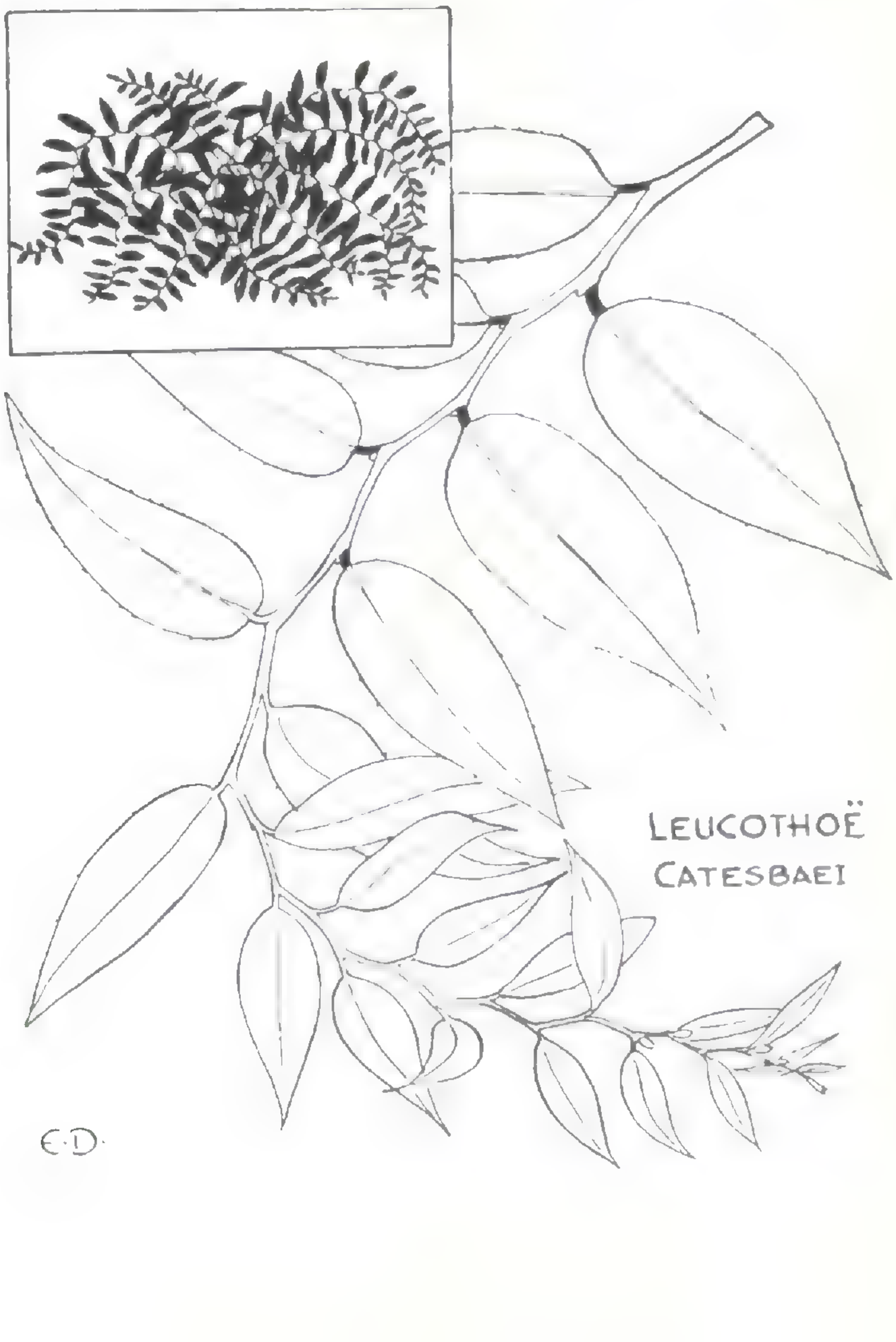
When well-grown, the Mountain Laurel is one of the finest of flowering shrubs. Although hardy throughout our area, this plant never develops the vigor it does farther east. It objects to drought and will sun-scald in winter sun. Should be grown in complete shade with protection from strong winds at all times. If cultural requirements can be met, quite respectable plants of the Mountain Laurel can be grown in our climate. The clusters of cup-like, light to deep pink flowers in May are the most distinctive features of this plant. Prefers a well-drained acid soil, pH 5.0–6.0.

26. *Leucothoë catesbaei* (Heath Family). 2–4 feet. DROOPING LEUCOTHOË
Introduced to gardens, 1793. Southeastern United States

Well-established plants develop an interesting, mound-like habit of growth. In May, the pendant trusses of creamy-white Pieris-like flowers are borne at the ends of the arching, smooth green branches, and contrast with the sage-green willowy leaves, 2–4 inches long. Rather slow to establish but the maximum height should be attained in less than ten years. Completely hardy throughout our area if planted in full shade. Sun will burn the leaves, summer or winter. Grown with considerable effect in a woodland landscape or as a low hedge along a shaded border; a bank or slope would suit the natural arching habit of this species. Spreads by underground runners.



~ILEX VOMITORIA~



27. *Magnolia grandiflora* (Magnolia Family). 20–30 feet. SOUTHERN MAGNOLIA
Introduced to gardens, 1734. Southeastern United States

A small tree in our area, highly esteemed for the handsome leathery leaves and waxy-white fragrant flowers, six to eight inches across. Leaves from 6–12 inches long and 4–5 inches wide are most common, but forms with leaves 2–3 inches and up to 6 inches wide sometimes occur. Brownish felt-like tomentum on the underneath surface of the leaves lends considerable beauty to some variants, but in other forms the leaves are completely glabrous on the lower surface. Flowering occurs mostly in June, but may continue sporadically all summer. In late summer and autumn, the seeds, with their bright red arils, further enhance the plant as they protrude from the brownish, felted cone-like seed pods. Plants less than ten years old are relatively tender and may freeze to the ground, but the roots rarely are killed. In winter, protection should be provided in the form of a burlap-covered frame. Old specimens rarely freeze back, although the leaves may turn brown during severe winters. An acid, well-drained soil, pH 5.0–6.0, suits this magnolia. Should be planted in full sun or partial shade. Flowering is prevented in full shade.

28. *Mahonia aquifolium* (Barberry Family). 4–8 feet. OREGON GRAPE HOLLY
Introduced to gardens, 1823. Western United States

A stiffly erect shrub spreading from rhizomes and suckering to form a dense bushy specimen or colony. Known for the lustrous, pinnately divided, spine-tipped leaves. The plant is extremely variable as to leaf shape and habit of growth. Racemes of chartreuse flowers are produced in early spring, followed in June by clusters of succulent, blue berries which are useful for making a mild-flavored jelly. Mature plants may be grown in about ten years. One of the few broadleafs fully hardy in either full sun or shade. Throughout our area the largest plants develop in semi-shade. In full sun the leaves turn maroon to brick-red in winter. Very adaptable in most well-drained, slightly acid to alkaline soils, pH 6.0–8.0.

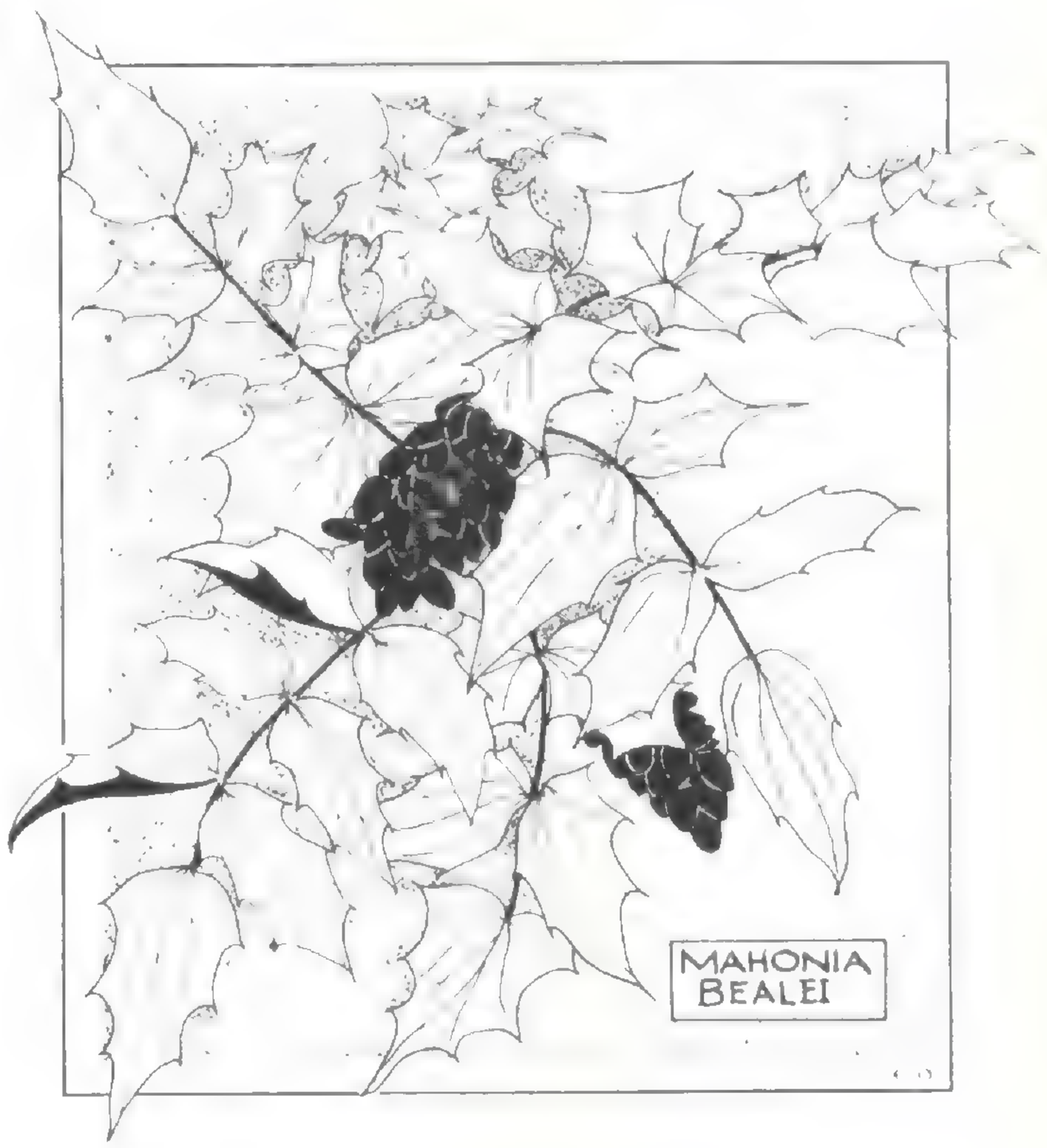
29. *Mahonia bealei* (Barberry Family). 4–5 feet.

JAPANESE or LEATHERLEAF MAHONIA

Introduced to gardens, ca. 1660.

China, Japan

Similar in aspect to the Oregon Grape Holly, but with stiffer, larger, thicker leaves, larger flowers and fruit. The handsome waxy leaves are about 12 inches long, somewhat drooping, whitish blue-green underneath and dull green above. Racemes of yellow flowers are borne at the summit of the plant in April. Grape-like clusters of blue berries follow in early June. In rich soil a growth of 6 inches a year may be expected. Completely hardy if planted in shade; but winter sun burns the leaves. Grows superbly on the north side of a dwelling or in a woodland beneath deep-rooted trees, such as oaks, hard maples, and hickories, in well drained soil high in organic matter, pH 6.0–8.0.

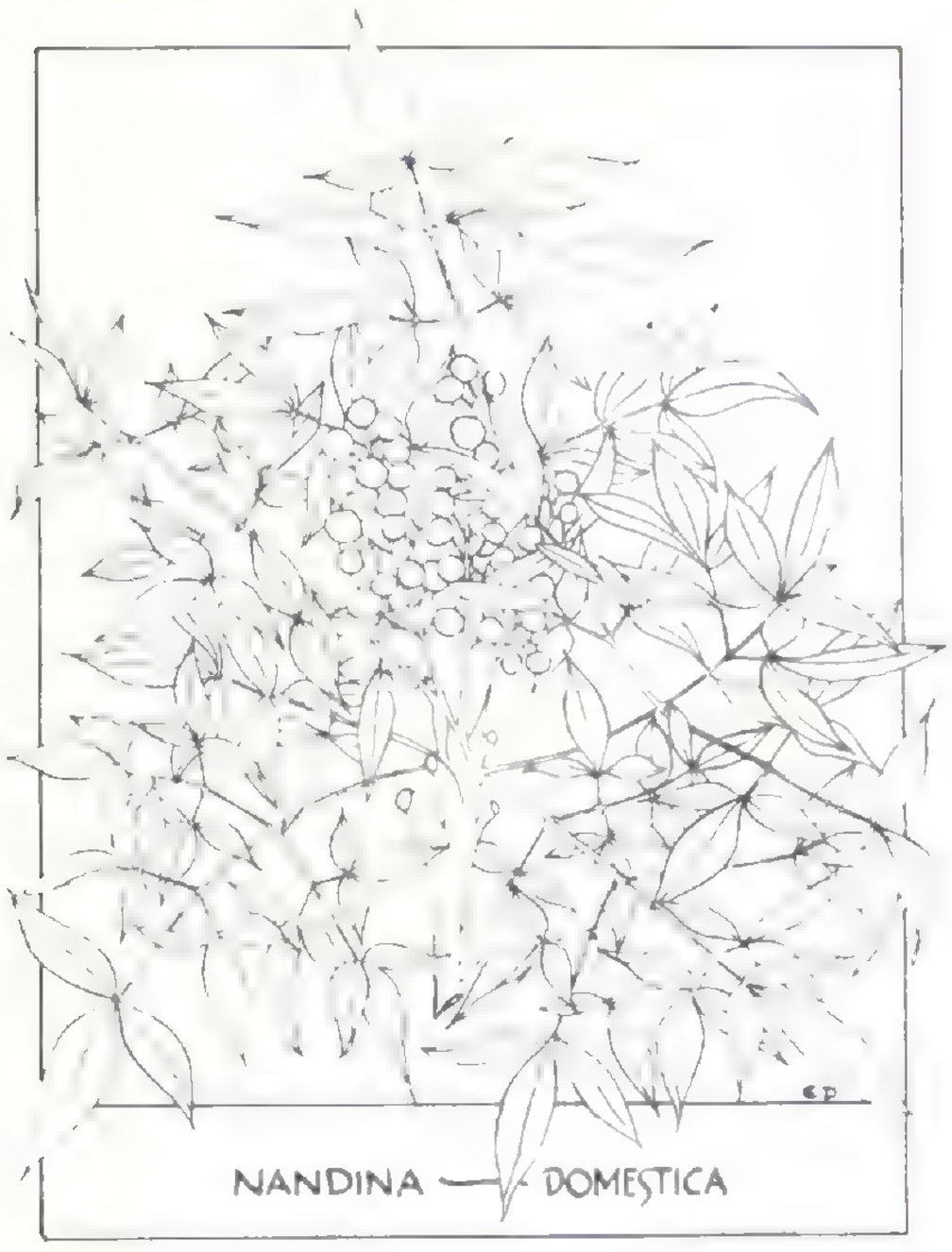


30. *Nandina domestica* (Barberry Family). 4–5 feet.

NANDINA

Introduced to gardens, 1804.

China, Japan



Known for the much-divided, almost fern-like leaves which radiate in densely tufted whorls mostly at the summit of the plant. Tiny, yellowish white flowers bloom in May. During the autumn and winter, heavy pyramids of striking orange-red berries rise from the central tuft of leaves. This shrub is slow to establish in our area and young plants normally drop their leaves and may freeze back, but they become hardier after a few years in a permanent location. Plant on the north or east side of a dwelling with a windbreak of hedges or high trees. May be grown on the south side of a

building if nearby trees provide shade. Does best in well-drained soil with about 50 per cent organic matter. A much-prized and ubiquitous dooryard shrub farther south. A yellowish-fruited form exists.

31. *Osmanthus ilicifolius* (Olive Family). 5–6 feet. HOLLY-LEAF OSMANTHUS
Introduced to gardens, 1856. China

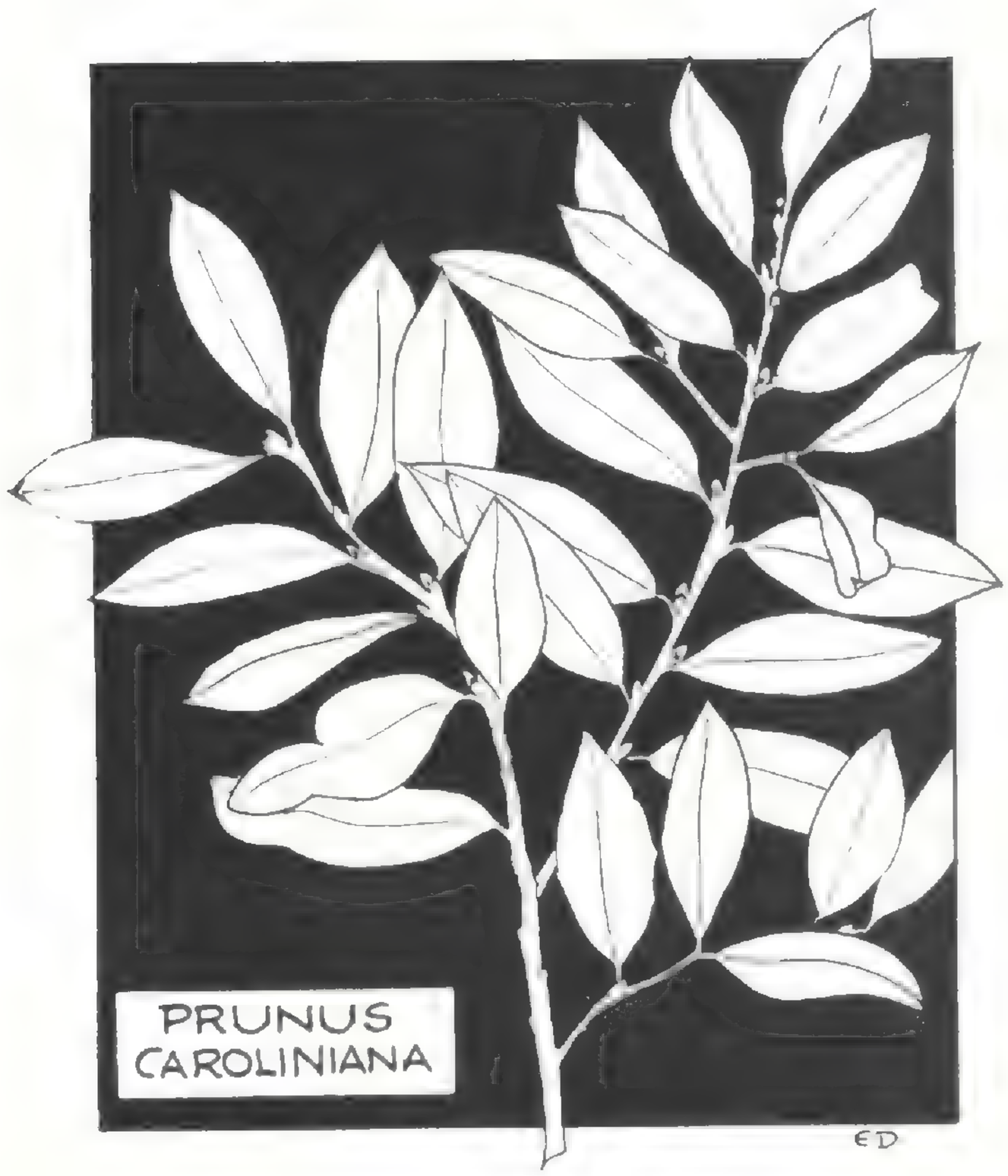
The evergreen, holly-like leaves, 1–1½″ long, and small extremely fragrant flowers, recommend this plant for hedge use or as a specimen. It should be planted in a location where it is in full shade during the winter, in a well-drained soil high in organic content. Protection from north and west winds should be provided.

32. *Pieris japonica* (Heath Family). 3–6 feet. JAPANESE PIERIS
Known in gardens, 1870. Japan

This flowering evergreen, although one of the most difficult to grow here, is highly prized for its foliage, cream-colored flowers, and graceful arching branches. In spring, the new terminal shoots appear, pink-tinged and erect like flaming candles in contrast with the pendulous racemes of creamy white flowers that resemble lilies-of-the-valley. Young vigorous plants may grow 5–6 inches a year. A well-grown plant may reach 6 feet after 10–12 years. Early fall and late spring freezes ordinarily damage Pieris more than minimum temperatures of mid-winter. Shade to prevent sun-scald is required at all times. A location on the south side of a wall, near a board fence, high hedge or by a dwelling with further protection on the west and north by trees is recommended. Grows best in well-drained, acid soil, with pH 5.0–6.0. Dislikes drought.

33. *Prunus caroliniana* (Rose Family). 8–10 feet
CAROLINA or AMERICAN CHERRY-LAUREL
Introduced to Gardens, 1800. Southeastern United States

A large round-headed, spreading shrub with lustrous green, leathery, cherry-like leaves, 2–3 inches long and nearly 1 inch wide. Sprays of pinkish white flowers appear on the branch ends during May. Fairly hardy, although young plants require protection from winter sun and freezing winds. Hardiness increases with age as plants acquire more bark and hard wood. Plant on the north side of a well or stockade fence or near a high hedge. On the south side of a dwelling, it should have shade to prevent sun-scald. Needs perfectly drained soil, neutral in reaction.



34. *Prunus laurocerasus* 'Schipkaensis' and 'Zabeliana' (Rose Family). 4–6 feet.
BULGARIAN CHERRY-LAUREL
Southeastern Europe
Introduced to gardens, 1898.

Cultivated for the lustrous leathery, evergreen laurel-like leaves 3–4 inches long. The 'Schipkaensis' differs from 'Zabeliana' in leaf width, two to three inches wide in the former and usually about an inch wide in the latter. Well-developed specimens of both cultivars form an irregularly shaped, often flat-topped plant nearly as wide as high and not unlike Pfitzer Juniper in aspect. Fairly rapid growing, 3–6 inches a year. Should be grown like the Carolina Cherry-Laurel. Very desirable plants with considerable promise in our area.

35. *Pyracantha coccinea* (Rose Family). 8–10 feet. FIRE THORN
Southeastern Europe
Introduced to gardens, 1629.

The typical form develops as a round-headed, sprawling shrub with widely spreading branches. Clusters of small white flowers cover the plant in May. Masses of orange to reddish berries which appear on the short spurs decorate the plant from early autumn throughout the winter. Fast growing;

PYRACANTHA COCCINEA
E·D·

a foot a year may be expected from a young plant in fertile, well-drained soil, pH 6.0–8.0. Fully hardy throughout our area. Thrives best in full sun; hardly worth planting in shade. Extremely useful for a fast-growing clipped hedge, as a dense unclipped screen, or as a specimen plant on the south side of a building where it is difficult to grow other plants in full sun. Highly drought-resistant. Can be successfully espaliered against a wall. Perhaps the finest berried evergreen shrub for our area.

Cultivar—'Lalandii', more upright and the branching habit less divergent than in the typical form.

Viburnum rhytidophyllum. Photo from Horace McFarland Co.

36. *Viburnum rhytidophyllum* (Honeysuckle Family). 6–8 feet.

LEATHERLEAF VIBURNUM

China

Introduced to gardens, 1900.

An interesting shrub with unusually large, deeply veined, leathery, drooping leaves, sometimes 8–10 inches long. Forms a dense, round-headed bush. The twigs and underneath side of the leaves are covered with felt-like tomentum. The upper leaf surface is dark green with deep-set veins. The small trusses of white flowers in May are not especially attractive, but the masses of red berries that develop in late summer contrast strikingly with the leathery green leaves. Fast growing, the maximum height may be reached in 6–8 years. Fully hardy, growing best at the edge of a woodland, on the north or east side of a dwelling or near a hedge. Should have protection from sun at all seasons. One of the toughest broadleafs grown here. Does best in slightly acid soil, pH 6.0–7.0.

BROAD-LEAVED EVERGREENS IN SOUTHEASTERN KANSAS—A FRINGE AREA

As compared to the St. Louis area, the climate of Kansas City is drier, and the frequency of strong west winds makes growing of introduced trees and shrubs considerably more perilous than 250 miles east. It is interesting to record below a few kinds of broadleafs that are being grown successfully at Ottawa, Kansas, about 60 miles southeast of Kansas City, in a climate where all but the most adventuresome of plantsmen would say it couldn't be done.

1. *Ilex crenata* 'Rotundifolia' and 'Helleri—both very desirable.
2. *Ilex cornuta*—needs heavy protection.
3. *Ilex opaca* 'Bountiful', 'Cardinal', 'Clarke', 'Hookstraw', 'Merry Christmas'—withstands full sun without burning.
4. *Kalmia latifolia*—requires much protection.
5. *Leucothoë catesbaei*—requires full shade where is does well.
6. *Magnolia grandiflora*—needs protection when young.
7. *Mahonia aquifolium*—does well.
8. Rhododendrons and Azaleas—old iron-clads and some of the Kurumes do well with adequate sun and wind protection.

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. (spring to fall) and until six (in the winter time) though the green-houses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission twenty-five cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The step-in gate (more or less concealed by the big Cleveland Ave. gate, 2221 Tower Grove) is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

MISSOURI BOTANICAL GARDEN BULLETIN

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Cover: Spraying the Garden elm trees.

Missouri Botanical Garden Bulletin

Vol. XLV MARCH, 1957 No. 2

THE GARDEN REPORT FOR 1956

HUGH C. CUTLER

DURING the past year the Garden has progressed in many directions, in spite of strict economies made necessary by rising costs. Plantings and displays have improved; the reorganization of the research facilities has advanced; the number of people using the Garden has increased. Although some repairs have been made, major renovating of greenhouses, buildings, pools, walks, and the heating and water systems has been postponed. To meet rising costs and to make repairs necessitated by depreciation, Garden operations have had to be reduced to the bare essentials. Over the years the Directors' reports have repeatedly stressed the need for funds to supplement the endowment left by Henry Shaw. Unlike most similar institutions, the Garden does not receive funds from city or state tax collections and it therefore needs aid if it is to continue as an outstanding institution. Following Dr. George T. Moore's retirement in February 1953, as Director, a position which he had held since 1913, Mr. John S. Lehmann, President of the Board of Trustees, acted as Director until Dr. Edgar Anderson was appointed to that office in April, 1954.

In 1956, Mr. Oscar Glaessner was appointed Business Manager and Secretary of the Board of Trustees. His understanding of methods and devotion to duties have improved our records and helped make possible many significant economies.

GARDEN

GREENHOUSES.

Plantings in all the display greenhouses were rearranged and the plants carefully labeled. Several truck loads of old plants were removed and many new ones were added. Large numbers of these new plants were acquired by Mr. Ladislaus Cutak (in 1956 Horticulturist in Charge of Conservatories, and now Greenhouse Superintendent) through gift or exchange. A carefully managed program of watering, fertilizing, cultivation, and spraying has kept the plants in good condition. In the Palm House, the Economic House and the Cactus House, the walks have been resurfaced with bricks. At the east end of the Citrus House a soft-drink vending machine was installed in a patio-like rest area where garden magazines donated by Friends of the Garden are available.

In the Palm House a representation of a tropical forest has been produced, with bromeliads and orchids growing from tree trunks and branches, and vine-clad palms extending high overhead. During the hot weather a striking display of Caladiums brightened the Economic House. The plantings

about the waterfall in the Aroid House were rearranged to create the effect of a tropical valley. For many years Mr. Cutak has been collecting all the known kinds of Philodendrons, and recently one of the pit-houses north of the Aroid House was opened to display what we consider to be the world's best collection of Philodendrons. In the pit-house, too, is a collection of Anthuriums, brought in from Gray Summit so that more people can see these showy tropical plants. Fog nozzles spray a mist which raises the humidity high enough to permit growing pitcher plants and many of the Gesneriads that need a moist atmosphere. Opening this pit-house which was formerly used for storing plants adds a new and unusual display house. Those who pass through it, leaving by the north door, are permitted to view the water-lily propagating tanks and watch the activities which go on in the propagation houses throughout the year. Water-lily varieties developed here by Mr. Pring, Superintendent, are now grown throughout the world.

The oldest greenhouse at the Garden and the only one remaining of those built during Henry Shaw's lifetime is the Linnean House. A gift of money from the St. Louis Garden Club, collected during its Spring Garden Tour in 1956, made it possible to initiate the long-needed restoration of this building. Some new Camellias have been planted and the ivy ground-cover and the fig-vine have been kept in such good condition that this is one of the most attractive greenhouses, even when the flowers are not in bloom. Now electric hedge clippers are used to prune the fig-vine and flood lights make it possible to have this house open for unusual evening displays.

The schedule of displays in the Floral Display House was about the same in 1956 as in previous years. The poinsettias remained until January and by adding Primroses and Cyclamens the show continued until the opening of the Orchid Show. Primroses, Cyclamens, Cinerarias, flowering bulbs, Genistas, and Kalanchoës were exhibited until the Easter Show, after which followed a display of Hydrangeas and other spring-flowering plants. During the summer, when the Display House became too warm for most flowering plants, an artistic arrangement of ornamental-leaved Caladiums occupied the floor. Included with the Chrysanthmum Show were two orchids, *Dendrobium Phalaenopsis*, the Baby Moth orchid, and *Cattleya Bowringiana*, not shown at the Garden before because of their susceptibility to smoke injury. They were arranged along the margins of the Chrysanthemum Show and in an area at the north end of the display house. The fact that these orchids held up well in spite of several days of foggy weather is a demonstration of how St. Louis has progressed in controlling the smoke and noxious gases which made it necessary to move the orchids to Gray Summit, back in 1926. Panels illustrating the different kinds of orchids and demonstrating the growth of orchids from seed, designed and painted by Mr. Paul Hale, a gifted gardener from Brighton, Illinois, supplemented the orchid exhibit. The unusual floral display arranged on the balcony of the Display House by the

members of the Chrysanthemum Society of St. Louis in 1955 attracted so much attention that the group was invited to make an even larger display in 1956. Baskets of chrysanthemums were hung in the Linnean House where they made a bright splash against the deep green of Camellias and climbing fig. Other chrysanthemum plants were scattered among the Camellias and about the pool. In the Shaw House a few cascade chrysanthemums were displayed on the mantels and in the entryway.

PLANTINGS.

Trees.—The Garden is world-famous for its research and its displays of both orchids and water-lilies. Now we are working to improve the outdoor plantings. The increased cost of labor just after most of our greenhouses were completed in 1916 meant a curtailment of outdoor activities to leave enough help to keep the greenhouses attractive. Also, in the years before the smoke-control program became effective, outside planting was discouraged in St. Louis because only the hardiest of trees and shrubs could survive. A count of the rings of the many weed-trees (mainly mulberry, tree of heaven, and silver maple) showed that most of them began to grow about 30 or 40 years ago. In the past year some 80 dead, dying, weedy or crowding trees were removed, and nearly as many new young trees have been planted. Oaks, gums, magnolias, conifers, dogwoods, bald-cypresses, hollies, several kinds of redbuds and new varieties of locusts have been planted according to the plans of Mr. John Noyes, former Landscape Architect to the Garden, or the plans of Mr. Emmet Layton, the Garden's present Landscape Architect.

The rare and beautiful old trees of the Garden are being fertilized, pruned and mulched. That this work has improved the trees is indicated by their resistance to ice and windstorms. For example, in 1955, a heavy wind meant a day of clearing fallen limbs and trees; now less than a quarter of the time is needed for such cleaning up.

Shrubs.—Throughout the Garden, shrubs have been pruned and fertilized, then mulched so heavily that little attention is now needed to keep out the weeds. A large number of old shrubs have been removed and replaced with nursery stock from the Arboretum or with plants acquired through gift or exchange. Fifteen bald-cypresses, a gift of the Forrest-Keeling Nursery, were planted about the water-lily pools. The dying Japanese Barberry about the main water-lily pool was replaced with a border of evergreen Julianae barberry. The plantings outside the main entrance to the Garden were redesigned by Mr. Layton and have proved to be very economical to maintain. In the nursery and ready to plant is a collection of new varieties of shrubs which, although the number of each kind is small, will give St. Louisans an opportunity to see how these plants grow in this climate.

Lawns.—The lawns at the Garden were fertilized in 1955 and again in 1956. They now have more bluegrass than they have had for many years. With careful management in the use of fertilizers and weed-killers, and with controlled mowing, we hope to continue the lawn improvement. Trial

plots have been laid out and samples of many kinds of bluegrass have been sown. A test of Bermuda U-3 in the circle in front of the Shaw House shows that, while this is an excellent grass for fast-growing and tough summer cover, it requires more frequent mowing than bluegrass and is not as attractive in winter. *Zoysia meyeri* plugs and sprigs gave tough summer lawn but did not give complete cover the first year; also, like Bermuda grass, it grew only during the warmest parts of the year.

Rose Garden.—With the help of members of the Rose Society and many other individuals, the Rose Garden has been kept stocked with new and old varieties of roses. The cool and moist early summer of 1956 resulted in one of the best shows of bloom we have had in recent years. Heavy mulches kept down weeds, conserved water, and reduced infections, such as black spot, which are spread by dirt splashed onto the leaves by rains and by watering.

Italian Garden.—The purchase of a used power generator made it easier to trim the hedges in the formal garden. This garden requires a large amount of hand labor as well as winter greenhouse space for growing the foliage plants which fill the beds. Photographs of the Italian Garden appeared in national magazines and in a Chamber of Commerce publication on St. Louis.

Economic Garden.—The south end of this garden has been cleaned and staked for the planting of a display collection of shrubs, mainly varieties of Forsythia and mock-orange.

Linnean Garden.—The Linnean Garden had its usual display of flowering plants although the wet spring made weeding difficult.

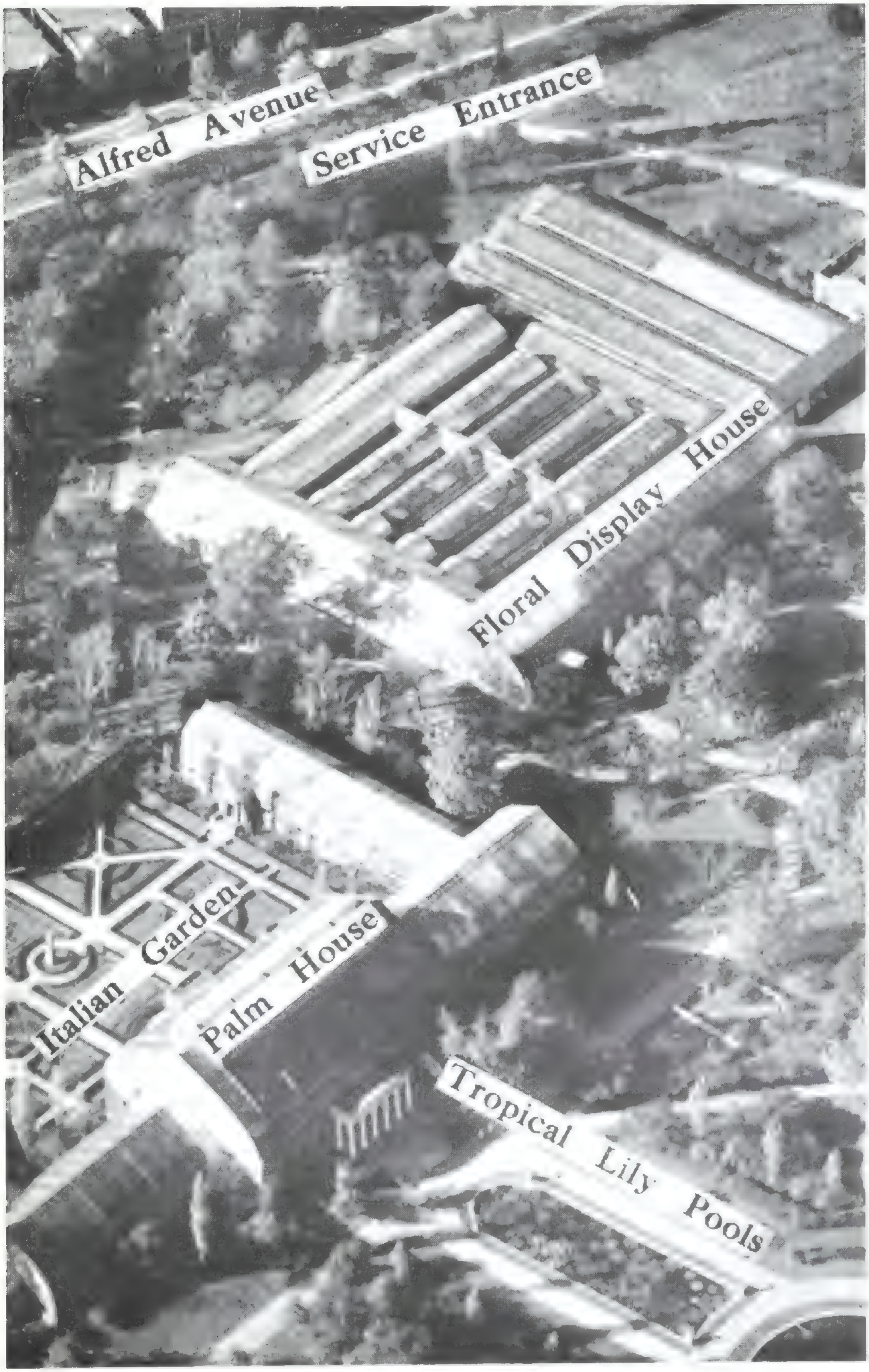
The Garden in General.—The extensive use of wood chips as mulch to conserve water and keep down weeds, the removal of narrow grass strips between beds of evergreen ground cover and the walks, the filling in of depressions in lawns so that mowers can cut evenly, and the use of herbicides to kill weeds, are only a few examples of methods being used to improve the appearance of the Garden and at the same time make it more economical to maintain.

Two iron benches bought with funds given in memory of Mrs. Susan M. Bryan were placed beside the Rose Garden.

MAINTENANCE.

Many Garden structures are in such poor condition that they should be replaced or completely reconstructed. Our small maintenance staff works diligently. For large repairs we have used outside help. It has been estimated that it will take at least $400,000 for needed repairs and replacements of structures and walks in the Garden.

Greenhouses.—Most of our greenhouses were built between 1912 and 1916, and they have been repaired, patched and reglazed several times in the past. In many places the woodwork is rotten, the iron rusted away. The Display House was strengthened and reglazed and painted in 1954 and 1955. The African House was painted and reglazed in 1955 and 1956. The north half of the Linnean House was completely repaired, reglazed, and repainted in 1956.



Shaw's Garden from the air: The Main Conservatories and the Service Eentrance

The woodwork in the Palm House and in the adjacent Fern and Economic Houses must be completely replaced. Only minor repairs and painting have been done in these houses. The Aroid House, Citrus House, and the propagation houses attached to the Floral Display House are in need of repairs, some of which have already been made to the ironwork. Loose and broken glass have been replaced. Planting directly in the soil in the greenhouses eliminated the need for starting plants in pots in the growing houses, and consequently several greenhouses were unused during the last two years.

Sheds and Garages.—Service sheds and garages have been cleaned and painted. A new arrangement of the tools and supplies, under the direction of Mr. Kenneth Smith, Engineer, and Mr. Louis Brenner, Grounds Superintendent, makes it possible to keep the supplies in better condition.

Residences.—Only minor repairs were made on the residences in the Garden.

Main Entrance.—At the main entrance, rooms were redecorated and new display windows built with the aid of a gift from the Beaumont Foundation. An Information Center has been established with a separate telephone line listed in the Telephone Book under "Missouri Botanical Garden Information Center". Most of the large number of requests for information are usually answered at once by Mr. Pring, Superintendent, who can draw on his more than fifty years of experience at the Garden. In his absence, replies are mailed out by post card or letter. The new display windows have featured a collection of herbs and publications prepared by the Herb Society, new garden books on special subjects, announcements of special tours, walks, Garden events and new house plants.

Administration Building.—The Administration Building was tuck-pointed and the window frames painted and caulked. This major job which had been put off many years for lack of funds was paid for with the proceeds of the 1955 "Christmas Adventure" which had been arranged by the Women's Committee.

Museum.—Mainly through the efforts of the Ladue Garden Club, the interior of the Museum has been cleaned and funds for painting it have been collected for work to be done this spring. The roof was strengthened, the skylight replaced with a section of roofing, and the plaster patched and painted with money from "Christmas Adventure".

Shaw House.—The Shaw House was restored in 1953, 1954, and 1955 with the help of a gift of $10,000 from Stix, Baer and Fuller and other gifts of money, furnishings and labor from many individuals. Mr. John Albury Bryan, architect for the National Park Service, gave generously of his time to supervise the work. Members of the Eighth District of the Federated Women's Clubs of Missouri have acted as hostesses and guides at the Shaw House since it opened, and as a result of their work, an increasing number of people visit the south end of the Garden. In 1956 the stucco on the house was repaired, the exterior waterproofed, and some floors repainted.

Several pieces of furniture, some of which had belonged to Mr. Shaw, were given to the house. It has been open daily from one to four except during the latter part of December, in January, and in February, when it was open only on weekends. It still houses the darkroom, several offices and workrooms, and some living quarters.

Heating System.—The heating system is in fair condition except for the transmission line from the Boiler House to the south end of the Garden which is in poor condition and must be replaced soon. Some of the pipes serving as heating coils in the various greenhouses were replaced. After making a study of the heating problems of the Shaw House and Administration Building a heat regulator was installed in the Shaw House.

ARBORETUM

At the Arboretum at Gray Summit only those features contributing directly to the enjoyment and instruction of the public are being maintained.

The dry weather of previous years had caused considerable damage to the trees, but this year, the Pinetum Lake filled with water and throughout the summer the Arboretum was quite green. The wildflower trails were frequented by a good number of visitors, especially during the month of April. During the dry fall we were fortunate not to have any serious fires. Mr. Frank Steinberg is now Superintendent of the Arboretum.

ORCHID DEPARTMENT.

Orchids are grown in the greenhouses at Gray Summit under the direction of Mr. Robert Gillespie. These greenhouses are open to the public daily from nine to four. Considerable progress has been made in adding new kinds and better-quality plants to the collections and in eliminating duplicates.

Research.—Control methods using pentachloronitrobenzene (an Olin Mathieson product known as Terrachlor) have been developed so that Oxalis and other weeds can be eradicated, saving hours of labor. Mr. Gillespie is investigating the environmental factors influencing flower initiation and development in several of the major genera of cultivated orchids. He has found that the flowering of many short-day orchid hybrids and of several of the Garden's long-day Cattleya hybrids can be controlled by light.

Cultural Techniques.—The use of new cultural methods—evaporative coolers, fog-line watering systems, automatic spray controls, adequate feeding and regulation of light intensity—has improved the quality of flowers and increased their production. Several mixtures of the bark of native Missouri cedar (*Juniperus virginiana*) and West Coast conifers (mainly *Abies concolor*) are being tested as potting and planting material for orchids. These bark mixtures are more economical than the fern fiber usually used and orchids can be planted more rapidly in them. We now have one bench of Cattleya hybrids and one of hybrid Cymbidiums growing in bark with subirrigation.

In an attempt to find a more satisfactory method of shading the orchid greenhouses, one half of the orchid seedling house was covered on the in-

side with polyethylene plastic film to reduce and diffuse the light. The plants under the plastic developed normally and the trial is being continued.

Plant Breeding.—Many of the rare and unusual orchids are being tried as parents of new types of hybrids which will be useful for our displays. Our extensive collection of orchid species represents a large untapped source of material for use in hybridization.

New Plants.—During 1956 the Garden acquired 296 orchid plants. Particularly noteworthy were the following:

17 Cattleya and Laelio-Cattleya hybrids, most of them award plants, donated by Mr. Alfred Proebstle of Brazoria, Texas.

10 fine hybrid cymbidiums, a gift of Longwood Gardens.

64 recently collected rare Ecuadorian orchids donated by Mr. José Strobel of Cuenca, Ecuador.

22 unusual orchid species received in an exchange with the Dublin Botanic Garden, Dublin, Ireland.

RESEARCH ACTIVITIES AT THE GARDEN

Many of the research activities closely related to the floral display and other public functions of the Garden have been mentioned earlier. Mr. Cutak's plantings of succulents and house plants, Mr. Gillespie's research on orchid growing methods, Dr. Meyer's trials of plants from Korea, Turkey, and Japan, Mr. Pring's studies on water-lilies and orchids, and Mr. Brenner's studies and practical trials of lawn grasses and food and cover plants for birds are research projects which are easy to relate to the parts of the Garden which everyone sees. But there are many other research activities which are not directly connected to the display gardens. Increasing numbers of these activities are supported by special grants and gifts from government agencies, foundations, industries and individuals. As provided in Mr. Shaw's will, much of the Garden research and teaching is closely tied up with Washington University; and many of the Garden's scientific staff have dual appointments.

A recent summary of the research activities at the Garden showed a wide range of projects completed in the last year or still under way. Some of the reports of this research have been published in the Garden's scientific quarterly, the *Annals of the Missouri Botanical Garden*; but an even larger number of reports have been published in other similar journals or presented as papers before scientific societies. The amount of work which is produced is great in comparison with the size of our staff and especially in view of the fact that there is little money available for the materials and assistants to carry out research.

One of the most important new activities connected with research at the Garden is the Annual Systematics Symposium, a discussion of the problems of the scientific classification of plants and animals. In 1956 at its third meeting, the Symposium was attended by 137 biologists. For the past two years these meetings have been supported by a grant from the National Science Foundation. With this financial aid, Dr. Tryon and the Herbarium Committee have been able

to arrange programs which attract outstanding plant and animal taxonomists and lead to stimulating and profitable discussions of problems common to both groups.

A LIST OF RESEARCH FIELDS OF STAFF MEMBERS

Dr. Edgar Anderson. Origin and evolution of plants.

Dr. Hugh Cutler. Origin and history of cultivated plants.

Dr. Henry N. Andrews. Fossil plants, especially the origins of fern-like and early seed plants.

Mr. Louis G. Brenner. Feed and cover plants for birds; lawn grasses.

Mr. Ladislaus Cutak. Taxonomy and culture of succulents and Philodendrons.

Dr. Carroll W. Dodge. Lichens and certain fungi.

Dr. John D. Dwyer. Taxonomy of certain legumes.

Mr. Robert J. Gillespie. Genetics and culture of orchids.

Dr. Frederick G. Meyer. Taxonomy of Valeriana; studies of certain cultivated plants.

Dr. Viktor Muehlenbachs. Flora of St. Louis.

Mr. George H. Pring. Water-lilies and orchids.

Dr. Julian A. Steyermark. Flora of Missouri.

Dr. Alice F. Tryon. The classification of the fern genus, Pellaea, and of medicinal and culinary herbs, especially geraniums and mints.

Dr. Rolla Tryon, Jr. Ferns of Peru.

Dr. George B. Van Schaack. Grasses.

Dr. Robert E. Woodson, Jr. Flora of Panama, studies in the Asclepiadaceae, and Apocynaceae, especially on Rauwolfia.

LIBRARY

Recently, extra effort has been devoted in the library to the serious problem of overcrowding. With rooms full of shelving and shelves full of books the only possible relief, as pointed out in previous years, was to weed out material without botanical interest, or marginal material easily accessible in other libraries in the city. Some of this material was transferred to the library of Washington University, partly as a gift, partly by sale. Much of it was sold elsewhere for an amount substantial enough to support the library program of acquiring new books, filling in journal sets and binding volumes. With the shelves relieved of unneeded publications enough rearrangement was possible to provide more comfortable reading quarters. The 'front' reading room can now be refinished and, with a few new chairs, it will be an attractive place to read and study.

The exchange program of the library continues to bring in a steady flow of several hundred botanical journals from all over the world. The library is now a member of the United States Book Exchange, a non-profit organization devoted to exchanging duplicate books and periodicals between member libraries of all countries. For very small fees the library has obtained missing journals and important books out of print or expensive to purchase.

Late in the year both of the assistant librarians, Miss Edna Mepham and Miss Ida Kohl, resigned their positions.

It had not been possible by the end of the year to find suitable replacements for these two employees of long standing.

HERBARIUM

The Herbarium carried on its usual duties of loaning, borrowing, accessioning and inserting. The principal figures for herbarium activity in 1956 follow:

Specimens inserted	6,987
Specimens accessioned for future mounting	4,394
Specimens sent out in exchange (to 5 institutions)	1,190
Specimens loaned (to 19 institutions, 2 foreign)	5,079
Specimens borrowed (15 institutions, 9 foreign)	4,737

The position of herbarium assistant was held by Mr. George Eiten of New York during the early part of the year and by Dr. Alfredo Cocucci of Cordoba, Argentina, the remainder of the year.

A major change in herbarium policy resulted from the decision to discontinue the mycological (fungus) section. Mycology, so vital in both plant pathology and medicine, has become such a vast field that the Garden with its limited resources, could make but a small contribution to its advancement. Accordingly, during the spring, the fungus herbarium was sold to the United States Government to be incorporated in the National Fungus Collections at Beltsville, Maryland. The removal of this collection provided the opportunity for a reassignment of space for the other collections. After a complete survey, these were shifted to equalize spacing and to segregate certain groups (lichens, ferns, grasses) in places more convenient to the staff members immediately interested in them. This rearrangement also made possible the removal of several herbarium cases to other locations, thus providing space in the more crowded parts of the herbarium for additional work tables. During the summer Dr. Emanuel Rudolph of Wellesley College was employed for a period of three weeks to curate the moss collection which had been stored in tin boxes on top of the regular herbarium cases. The mosses were replaced in standard cabinets and are now easily accessible for study.

ATTENDANCE

During the past few years attendance has been relatively low; a fact which may be attributed to a movement to the suburbs, or to more interest in television. We are trying to increase the attendance by improving the parts of the Garden that a visitor enjoys and by publicizing the attractions of the Garden. In 1956 we had some success. Attendance figures for the past four years are:

1953	207,998	1955	156,297
1954	215,045	1956	198,472

These figures represent only those for people who enter through the main gate turnstiles. Increasing numbers of people are entering through the Cleveland Avenue entrance, especially on weekends, to visit the Shaw House and the Mausoleum area.

We have been helped by many people in our effort to let the public know what the Garden is doing. A large part of the work has been done by members of the Women's Committee,

with publicity releases managed by Mr. and Mrs. Rollo Horwitz. The volunteer guides, under the leadership of Mrs. Paul Britt, conducted 76 special groups of visitors through the Garden. Members of our staff and the Horticultural Council have lectured to many societies and given information to amateur gardeners. Following are some special shows and organizations that have helped to sustain public interest in the Garden.

The Cactus and Succulent Show managed by the Henry Shaw Cactus and Succulent Society has been given since 1942 and the 1956 show was one of their best.

The Dahlia Show, given since 1950, is growing each year.

The Fall Harvest Show, first given in 1954, was excellent and the men responsible for the staging of this big event expect the 1957 Harvest Show to be an outstanding one.

The Gladiolus Show had many more flowers exhibited in 1956 than in the first show in 1955, and there was a large number of new varieties as well as old standbys such as White Gold and Picardy.

The African Violet Show, first given in 1955, attracted a large crowd. A series of newspaper articles on African Violets with a feature article about Mrs. Tretter, one of the most active of the African Violet Society members, brought many new visitors to the Garden.

The St. Louis Chysanthemum Society maintained a large display on the balcony of the Display House during the Chrysanthemum Show. The quality of the many kinds of flowers, together with the fact that many of these were grown by busy men in their spare time aroused much interest. The 1956 display was their second one.

Many meetings were held in the Garden. On one day, for instance, there were four meetings at the Garden going on at the same time—in the Museum, the Greenhouse classroom, the Shaw House, and under the pergola of the Italian Garden. Occasional meetings are held in the Display House and now that the balcony has been surfaced, this makes an excellent place for certain activities. The Marguerite Krueger Conservation Club held a luncheon there, overlooking the display, and called it "A Picnic in the Garden".

Friends of the Garden. The number of members has increased considerably as the result of the efforts of Mr. Towner Dean, Mr. Dudley French, the Women's Committee and many volunteer helpers. About 2,000 envelopes were addressed as a part of a campaign which brought in new members and told many people about the activities of the Garden.

The Women's Committee of Shaw's Garden has helped in so many events in the past year that only a few can be mentioned. "Henry Shaw's Christmas Party" was given in the Shaw House and the Museum and it, like "Christmas Adventure" the previous year, was a spectacle enjoyed by everyone who came. Unfortunately, the weather was bad during its scheduled opening and it was held over for another weekend; yet, in spite of the weather, more than $4,000 was raised.

Volunteers from the Women's Committee have helped in the library and in the gardens and greenhouses.

Evening showings of the Orchid and the Chrysanthemum Shows and a special showing of the Daffodils at Gray Summit were arranged for the Friends of the Garden by the Women's Committee.

The National Council of State Garden Clubs. The greatest of all developments in gardening has not been the discovery of weed-killers or new plants but rather the emergence of the amateur gardener and of organized garden clubs. The Garden has been fortunate in having the National Council of State Garden Clubs decide to establish their national headquarters in St. Louis and within the Garden on land which the court permitted the Garden to sell for that purpose. The funds for the purchase of the land were a gift from interested St. Louisans. In August, 1956, there were 10,893 clubs and 352,882 members in the National Council, the largest of organized gardening groups. Plans have been drawn for the building and most of the funds collected for its erection which will start soon.

Bequests to the Missouri Botanical Garden may be made in securities, money, or books. They may, if desired, take the form of a memorial to a person, to be named by the giver.

Bequests to the Garden by will are deductible, without limit, in determining the federal estate tax and are exempt in any amount from Missouri and Illinois state inheritance taxes.

For those desirous of making bequests to the Missouri Botanical Garden, the following form is suggested:

I do hereby give and bequeath to the Trustees of the Missouri Botanical Garden of the City of St. Louis, State of Missouri:

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George B. Van Schaack.....Acting Curator of Herbarium
Trifon von Schrenk.....Associate Curator of the Museum
Robert E. Woodson, Jr.....Senior Taxonomist

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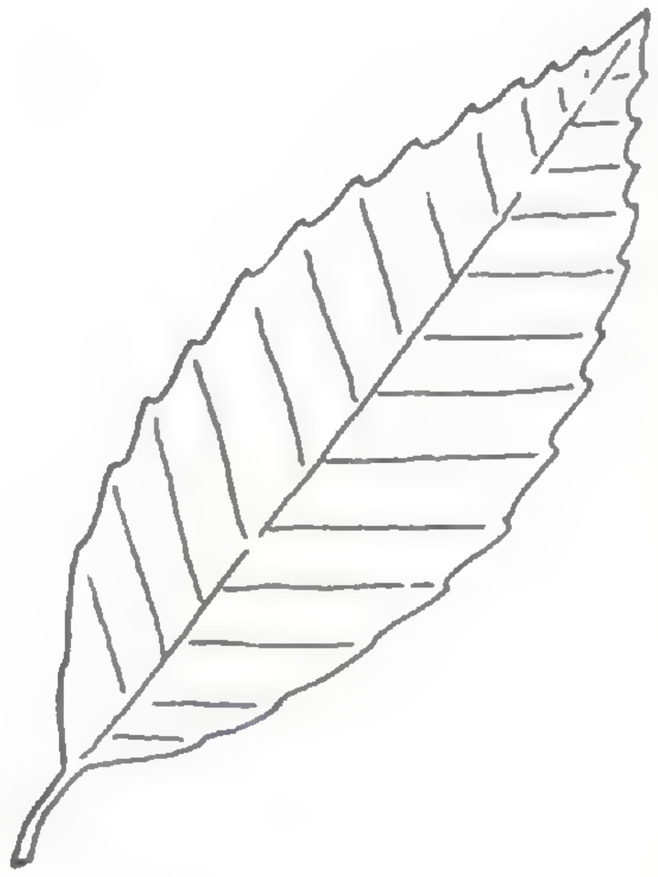
SOME FACTS ABOUT SHAW'S GARDEN

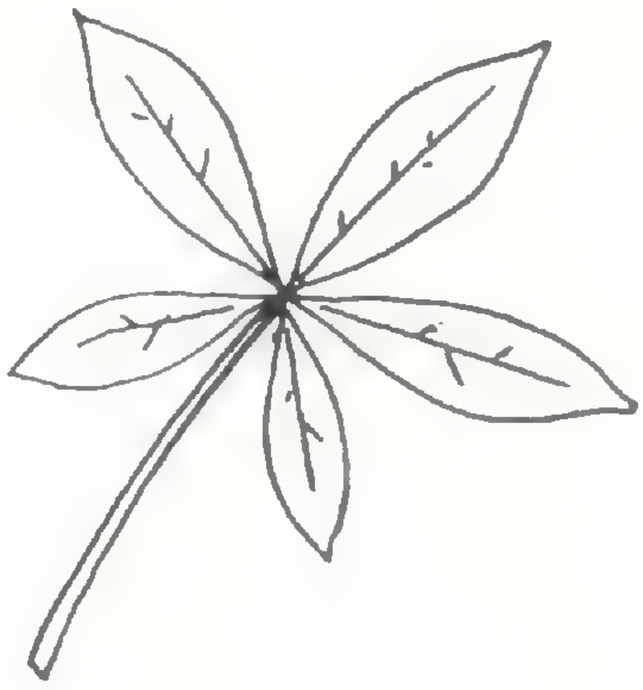
The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

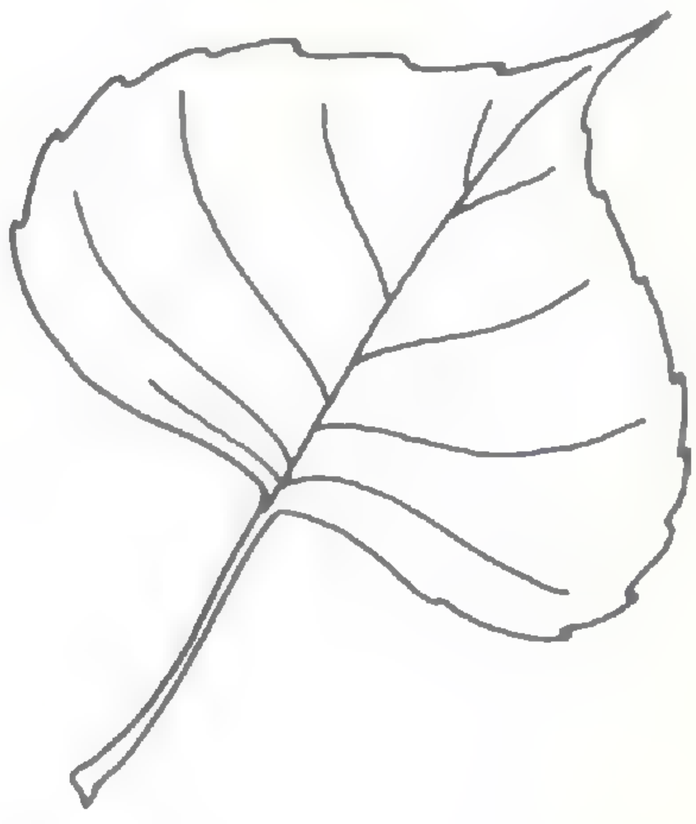
The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. spring to fall and until six in the winter time though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission twenty-five cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The step-in gate (more or less concealed by the big Cleveland Ave. gate, 2221 Tower Grove) is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

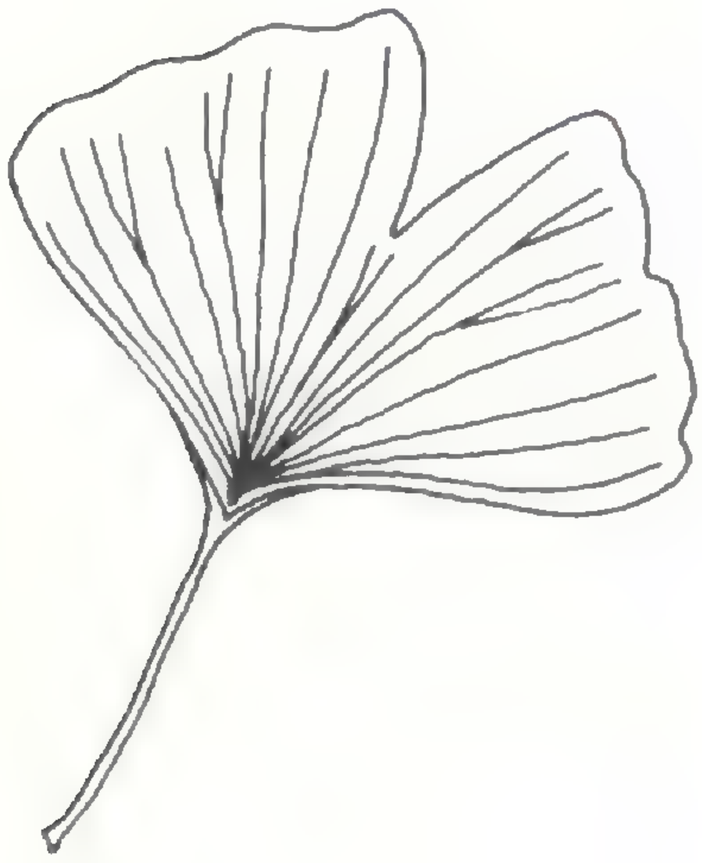
Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi which are at their best in April.

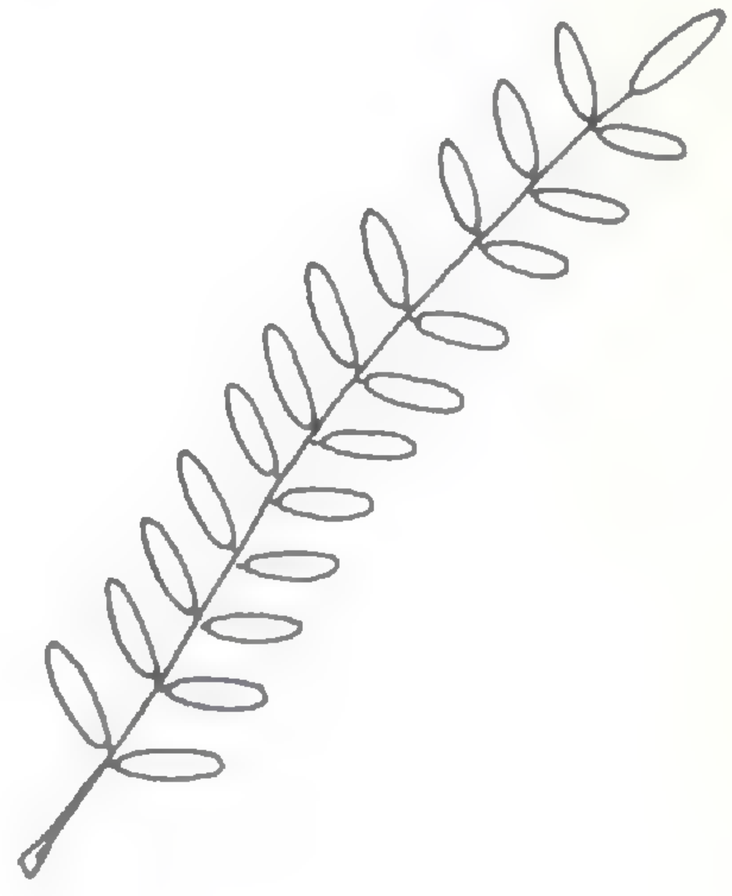
Good Shade Trees
for the
Central Midwest











Missouri Botanical Garden

Price 25 cents

Beech

Bald Cypress

White Ash

Cottonwood

Buckeye

River Birch

Honey Locust

Hackberry

Ginkgo

COVER: Leaf outlines (for Bald Cypress, the outline is of a twig with many short, needle-like leaves), characteristic of trees mentioned in this bulletin, are shown on the front and rear covers. On the reverse side of each leaf outline (on the inside covers) appears the silhouette and name of the tree represented.

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GOOD SHADE TREES FOR THE CENTRAL MIDWEST

LOUIS G. BRENNER

It is not easy to select shade trees for the Central Midwest, particularly the St. Louis region. Because the local climate is characterized by extremes in temperature and rainfall many shade trees valued for their flowers, leaves or form of branching cannot be grown readily. Some shade trees of the Northeast where they grow in more moderate climatic conditions would be extremely difficult to grow in the Central Midwest where summer daytime temperatures may soar above 100 degrees, or where winter temperatures may vary as much as 50 degrees in less than 24 hours, often plunging to below-zero readings. The late spring freezes characteristic of this region often come at a time when the sap is rising in the trunk and the leaf and flower buds are swelling; consequently, flowers, young branches, or even small trees may be frozen. Periods of drought which may last from four to more than 12 weeks are usually combined with abnormally high temperatures and frequently result in midsummer defoliation, numerous dead branches and even death of trees. In this bulletin is presented a list of more than 20 shade trees which, through years of growing on the grounds at the Missouri Botanical Garden and in gardens and parks in the vicinity of St. Louis, have proved hardy to the many adversities of our Midwest climate. It is suggested that gardeners and homeowners select their shade trees from this list. Some of the good and bad features of each species and the soil conditions most favorable to its culture will be noted. The accepted methods of planting, pruning, fertilizing, watering and control of insect pests and diseases will be discussed briefly.

SUGGESTIONS FOR THE SELECTION OF SHADE TREES

Only when trees are carefully selected, considering such features as height at maturity, spread of branches, soil preferences, rate of growth and problems of maintenance above ground and in the soil, can they be relied upon to give continuing satisfaction and pleasure. Choosing the proper tree to fit the location is a prime consideration. For example, there is little need to plant a large shade tree in a small corner where it will require annual pruning to keep it within bounds. Today there is an ever-growing list of good small trees which are excellent planting material for ranch-house type

of architecture. Trees of several sizes and shapes are to be found among those listed here. When selecting trees it is important to know the type of soil in which they are to be planted. Examine the soil to a depth of about two feet and determine its composition, whether clay, loam, sand. If, for example, a gummy, yellow or red clay is found, then select trees from the small group known to grow well on clay soil. Rate of growth of trees is another point for consideration. Many home owners, particularly those in new tree-bare subdivisions, are interested in fast-growing trees for quick shade. This is of course to be encouraged; however, fast-growing trees are usually not long-lived and are easily storm damaged. If their use is planned, then slower growing and more durable species should be planted in locations where permanent trees are desired, using the fast growers as fill-ins to be removed some five or ten years later or as soon as the permanent trees have made sufficient growth to provide some shade. Features of trees which may make them maintenance problems should be carefully considered. Certain trees can be a nuisance if planted near tile drains for their moisture-loving roots seek out the tiniest opening in the drain to enter in search of water and soon the drain pipe is choked with a mass of roots. Some trees offer pruning problems if planted near walks and drives. Others are a nuisance when planted near walks, drives, or paved terraces because of their messy fruiting habits.

In the following list the trees have been arranged alphabetically according to their common names. Scientific names are added not only as a matter of interest but because they may be of value in obtaining the precise species desired, since common names are not uniform.

Ash.—Height: 60–80′; habit: round.

The ashes are large forest trees and should always be planted where they will have sufficient room to develop their broad spreading crowns. The White Ash, *Fraxinus americana*, is considered to be the best of the ash species for Midwest planting. It suffers shock of moving fairly well and is a rather fast-growing tree when established. Succeeding on most soil types, the White Ash will make fair growth in clay. It may be attacked by boring insects and should be examined frequently for their presence, especially during the first years after planting. Keeping the tree growing actively is the best guard against borers. The ash is subject also to attacks of several scale insects and may need periodic spraying. The tree offers interesting fall coloration in shades of orange through mauve-purple.

Bald Cypress.—Height: 80–90′; habit: narrowly pyramidal.

The Bald Cypress, *Taxodium distichum*, is a much-neglected tree. It is best suited for large properties and, although primarily a tree of the southern swamplands, it has proved capable of fast growth on upland soils; however, it is not recommended for planting in clay soil. It is virtually without insect pests and diseases. The fine feathery leaves turn a rich bronze in autumn and they and the small twigs

that fall with them are so fine as to require no raking from the grass. More of these fine trees should be planted. They would make outstanding avenue trees for some city and subdivision streets.

BEECH.—Height: 30–60′; habit: pyramidal.

Fagus sylvatica var. *atropunicea*, the Copper Beech, a European species, is to be preferred over the native American Beech in average soil conditions. The Copper Beech is truly a tree of outstanding merit and should be treated as a specimen, never hidden in a corner nor crowded among other trees. The bronze blush of the expanding new leaves in spring is breath-taking and surpassed only by the deeper bronze-purple of the mature leaf. Good soil is recommended for the beech; and, because the feeding roots lie near the surface of the soil, it will grow best if heavily mulched and the lower branches permitted to sweep the ground. Columnar and weeping varieties of the Copper Beech are also available.

BIRCH.—Height: 40–60′; habit: pyramidal.

Unfortunately, the beautiful white-barked birches are considered poor planting material for the midwest because they are not drought resistant. Our native Red or River Birch, *Betula nigra*, a tree with red-brown bark, small leaves, and of graceful, pendulent branching habit is longer lived but requires a loam soil for even moderate success. The leaf miner, a tiny insect, sometimes skeletonizes the leaves in summer, and the trees should be sprayed soon after the leaves have fully expanded.

BUCKEYE or HORSE-CHESTNUT.—Height: 70′; habit: pyramidal.

The buckeyes are generally considered among the less desirable shade trees because of their large coarse leaves and fruits and their poor fall coloration. They are listed here because they will grow on most soils and they have few insect pests and diseases. The Horse-Chestnut is often admired for the above-average symmetry of the crown and also for the large showy, upright flower spikes which create a candelabra effect. The European species, *Aesculus hippocastanum*, is frequently planted. Although it forms a large and stately tree, it has the disadvantage of having weak wood which is easily broken by wind and ice. Also the leaves are susceptible to a rust which may cause them to become brown and fall in late summer. The Baumann Horse-Chestnut, *Aesculus hippocastanum baumanni*, has double flowers which are not only showy but are followed by few seeds, since the extra petals are formed from parts of the flower ordinarily involved in seed production. The hybrid Ruby Horse-Chestnut, × *Aesculus carnea briotii*, is somewhat more rust-resistant and has flowers larger than those in the common Horse-Chestnut. Flowers of the Ruby Horse-Chestnut are bright scarlet in contrast to the pale, flesh color of the common species. Horse-Chestnuts bear two or three seeds or buckeyes in a spherical pod about two inches in diameter, with a tough, warty or spiny outer coating. Seeds and pods clutter the lawn when they fall in September. Older trees producing fruit in quantity make it necessary to rake the lawn

before mowing to prevent the mower blades from jamming on the hulls. The modern rotary mower will, of course, mow over the hulls shattering them but leaving a rough-appearing lawn.

COTTONWOOD.—Height: 70′; habit: widespreading.

The Cottonwood, also known as Poplar, has an important place in this list. The Eastern Cottonwood, *Populus deltoides*, recommended here, is a rapidly growing tree and fills the need for quick shade so often demanded by owners of new tree-bare homes. However, since the Cottonwood and all other poplars are short-lived trees (15–20 years), they are most useful as temporary plantings among more desirable long-lived trees. The Cottonwood will grow on most soils; but it has a great affinity for water and will rapidly clog drains if it has the opportunity. The leaves become yellow in the fall and the gray-green of the bark on younger limbs may serve the same decorative purpose as the bark of the birch and sycamore. Unlike most trees the Cottonwood has leaves so constructed (the petiole is flattened in a plane perpendicular to the plane of the leaf-blade) that the slightest movement of air causes the leaves to quake. Thus on warm summer evenings the rustling of the leaves of the Cottonwood gives the impression that there is more movement of air than there actually is and may result in a pleasant cooling sensation. The Cottonwood has few insect pests. It has the bad habit of dropping its leaves during summer at any time that it may suffer a shortage of water.

The Lombardy Poplar, *Populus nigra italica*, the well-known graceful, columnar poplar, should also be included; although the Simon Poplar, *Populus Simoni*, which forms a less compact column, is more winter-hardy and also seems to withstand summer heat and drought better. Since these poplars tend to have numerous dead limbs and trunks as they approach 15 years of age, when used as screen plantings they should be cut to short stumps periodically. If such cutting is followed by moderate application of fertilizer and abundant water, the poplars rapidly renew the screen effect.

ELM.—The elms are mentioned here with words of caution and without recommendation. Prevalence of two serious diseases, the much dreaded Dutch Elm Disease and Phloem Necrosis, for which as yet complete cures are not known, make them of questionable value. For those insisting on the elm, the Smooth-leaved Elm, *Ulmus carpinifolia*, of the variety "Christine Buisman" is reportedly resistant to both diseases mentioned.

GINKGO.—Height: 80′; habit: broadly pyramidal to columnar.

The Ginkgo, *Ginkgo biloba*, is an outstanding tree for Midwest planting, succeeding on most kinds of soil and tolerant of urban conditions. It attains considerable size at maturity (more than 50 years), and should be planted with this in mind. Ginkgo is essentially columnar in youth and develops a broad pyramidal habit with age. A selected type, the Sentry Ginkgo, maintains its columnar form throughout life and is well suited for avenue planting provided only male

trees are planted. Female trees of the Ginkgo can be a nuisance in late fall if planted where the fallen fleshy persimmon-like fruits may be crushed, for the pulp is putrid, containing butyric acid, the same acid present in rancid butter. The trees are of easy maintenance, having no insect pests or diseases.

HACKBERRY.—Height: 50–70′; habit: round.

The hackberry with its small leaves, rounded crown, ease of moving and adaptibility to most soils could well be looked upon as a substitute for the elm; however, being of more erect branching habit it lacks the graceful appearance of elms, particularly the American Elm. The trees bear large quantities of small, round, blue-black fruits which are much enjoyed by many kinds of birds in winter. The native Hackberry, *Celtis occidentalis*, is susceptible to a fungus causing a great massing of smaller twigs into what is called a "Witches Broom". Such fungus attacks rarely prove fatal to the tree and result in the interesting "tufted" appearance of the branches in winter. Witches Brooms are less common on the Sugar Hackberry, *Celtis laevigata*, of the southern states, which may be grown here. Asiatic species of Hackberry are free from the fungus but they are not commonly available in the nursery trade.

HONEY-LOCUST.—Height: 70–90′; habit: round.

The Honey-locust, *Gleditsia triacanthos*, has long been neglected as a shade tree in the Midwest. Locusts make ideal lawn trees because they leaf-out late in spring and drop leaves early in fall permitting plenty of sunlight to reach the lawn in the cooler seasons. The tree grows rather fast even on clay subsoil. It has few insect pests or diseases. Since the common native variety habitually arms itself with vicious thorns, often four inches or more in length, the thornless type sold under the patented name of "Moraine Locust" is recommended. The Honey-locust is sometimes considered an untidy lawn tree because the much-twisted strap-like pods need to be raked from the lawn in the fall, winter, and very early spring. Pods remaining on the tree in winter do have a decorative value. The thornless Moraine Locust is sterile and few if any pods are formed.

LINDEN.—Height: 60–80′; habit: pyramidal.

The American Linden, *Tilia americana*, is a forest tree with large leaves. Its fall coloration is dull and it grows poorly on graded sites with clay subsoil. For home planting, the Little-leaf Linden, *Tilia cordata*, a European species, is considered superior. The Little-leaf Linden makes moderate growth, excellent shade, and colors a clear yellow in autumn. This tree has few insect pests and diseases, which makes it an easy tree to maintain. The small flowers of the Linden are borne on special, long, spatulate-shaped leaves; their fragrance attracts honey bees that make an excellent honey from the nectar.

MAPLE.—Height: 30–70′; habit: round.

The maples comprise a group of much-loved shade and lawn trees. Perhaps best known is the Silver Maple,

Acer saccharinum, commonly planted because of its rapid growth and ability to grow on even the worst soils. It is a tree of few pests, but the wood is soft and is liable to much injury from winter ice storms. The Red Maple, *Acer rubrum*, is also considered to have weak and brittle wood and, like the Silver Maple, suffers ice damage. However, because of its bright red flowers in very early spring and its brilliant red and orange foliage in the fall, it is considered superior to the faster-growing Silver Maple. Maples with harder, more durable wood are the Sugar Maple, *Acer saccharum*, slow-growing and with brilliant fall colors, and the Norway Maple, *Acer platanoides*, which makes a superior lawn tree and is faster growing than the Sugar Maple. Norway Maples may be had in several varieties, of which "Crimson King" is outstanding for its deep purplish-red leaves. The Japanese Maple, *Acer palmatum*, and the Hornbeam Maple, *Acer carpinifolium*, are two small maples reaching 20–30 feet in height and usable for small homes and yards. Most maples have numerous shallow feeding roots and cast rather dense shade, making lawn management beneath them difficult.

Oak.—Height: 70–90′; habit: pyramidal.

Oaks have a long life span and their tough wood enables them to withstand the worst storms. Despite the fact that they are reputedly slow-growing, they may compete favorably with more rapid-growing trees if they are fertilized. The White Oak, *Quercus alba*, is one of the most majestic trees, although it is rather difficult to move and establish. It will grow best in loam, or loamy clay soil. The Bur Oak, *Quercus macrocarpa*, makes a superb tree of moderate growth. A faster-growing oak than those previously mentioned is the Northern Red Oak, *Quercus borealis*; and it is easier to move and establish. It too is a very desirable tree and reaches great size as do all the oaks mentioned here. The Pin Oak, *Quercus palustris*, is perhaps the most commonly planted oak. Although it is a fast-growing tree and responds well to fertilizers, it has a much shorter life span than most oaks and will probably need to be removed in 40–50 years. The habit of holding many of its leaves through the winter and dropping them in very early spring makes the Pin Oak a nuisance to meticulous gardeners. All the oaks mentioned here present fine autumn coloring in various shades of red and purple.

Sweet Gum.—Height: 50–70′; habit: pyramidal.

The Sweet Gum, *Liquidamber Styraciflua*, has proved to be an excellent tree for Midwest planting. It is easy to move when bought with a burlapped ball of soil, and it grows well in almost any soil. The star-shaped leaves turn shades of orange then shades of scarlet with the first autumn frosts. The fruits are horned balls about 1-inch in diameter and the seeds are eagerly sought in the grass beneath the trees by such birds as quail, cardinals and sparrows. Most of the seed balls decorate the tree throughout the winter. Occasionally the trees may need to be sprayed for the Tussock Moth and Tent Caterpillar.

SYCAMORE.—Height: 80′; habit: broadly pyramidal.

The Sycamore is so commonly planted on our city streets that it hardly needs introduction. It is very adaptable to most soil conditions and even makes fair growth on clay sub-soils. It withstands the heat and contaminated air of our large cities and is a reasonably fast-growing tree. Our common native Sycamore, *Platanus occidentalis*, is susceptible to a twig blight to which the London Plane Tree, *Platanus acerifolia*, and the Oriental Plane Tree, *Platanus orientalis*, are resistant. Sycamores are all coarse-leaved trees with the bad habit of dropping leaves and shedding bark throughout the growing season; although the smooth, light-colored newly-exposed bark is one of the most attractive features of these trees. New leaves of Sycamores have many fine hairs on their lower surfaces, and as the leaves become fully expanded and mature the hairs are blown loose and may cause a nasal irritation to some people.

TULIP TREE.—Height: 80′; habit: pyramidal.

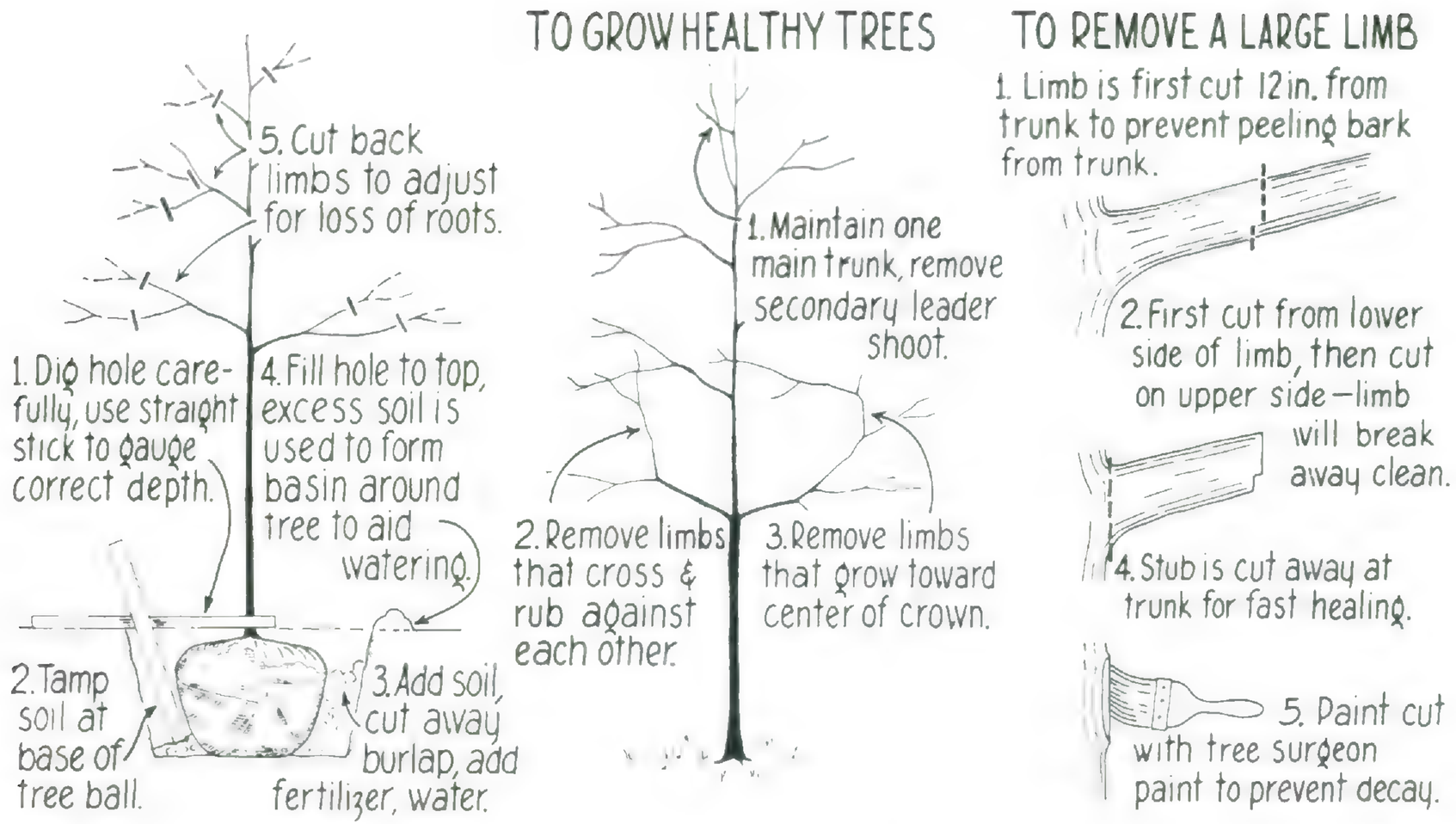
The Tulip Tree, *Liriodendron tulipifera*, has been so named because the pale, yellow-green flowers resemble a broadly expanded tulip. Were it not for the fact that the flowers are usually hidden by the leaves the Tulip Tree would be a very showy tree. The tree grows to great size and succeeds best on a loam soil. It is not an easy tree to move and every precaution should be taken to make sure the fleshy roots do not dry out when it is taken from the ground. It has few insect pests and diseases. A columnar form of the Tulip Tree is an attractive avenue tree. The leaves turn bright yellow in autumn.

ZELKOVA.—Height: 40′; habit: round.

The Zelkova, or, more properly, Japanese Zelkova, *Zelkova serrata*, makes an excellent substitute for the elm to which it is closely related. It is a fine tree for the smaller homes and gardens and bears small elm-like leaves that turn a light golden yellow in early fall. It develops a wide-spreading rounded crown and since the wood is tough and limber it bears up well under our dreaded winter ice. Like the elm, the tree is easily moved.

HOW TO PLANT AND CARE FOR SHADE TREES

Planting.—Usually the better grade of trees bought from the nursery are sold with a ball of soil about the roots tightly wrapped in burlap. These trees are listed in the nursery catalog as "B&B", or "balled and burlapped". Such trees, aside from being heavy, are by far the easiest to handle in planting and they are quick to re-establish in the new site. Many small trees are sold in tin cans or similar containers, which makes them easy to plant with high degree of success. An additional feature of the canned tree material is

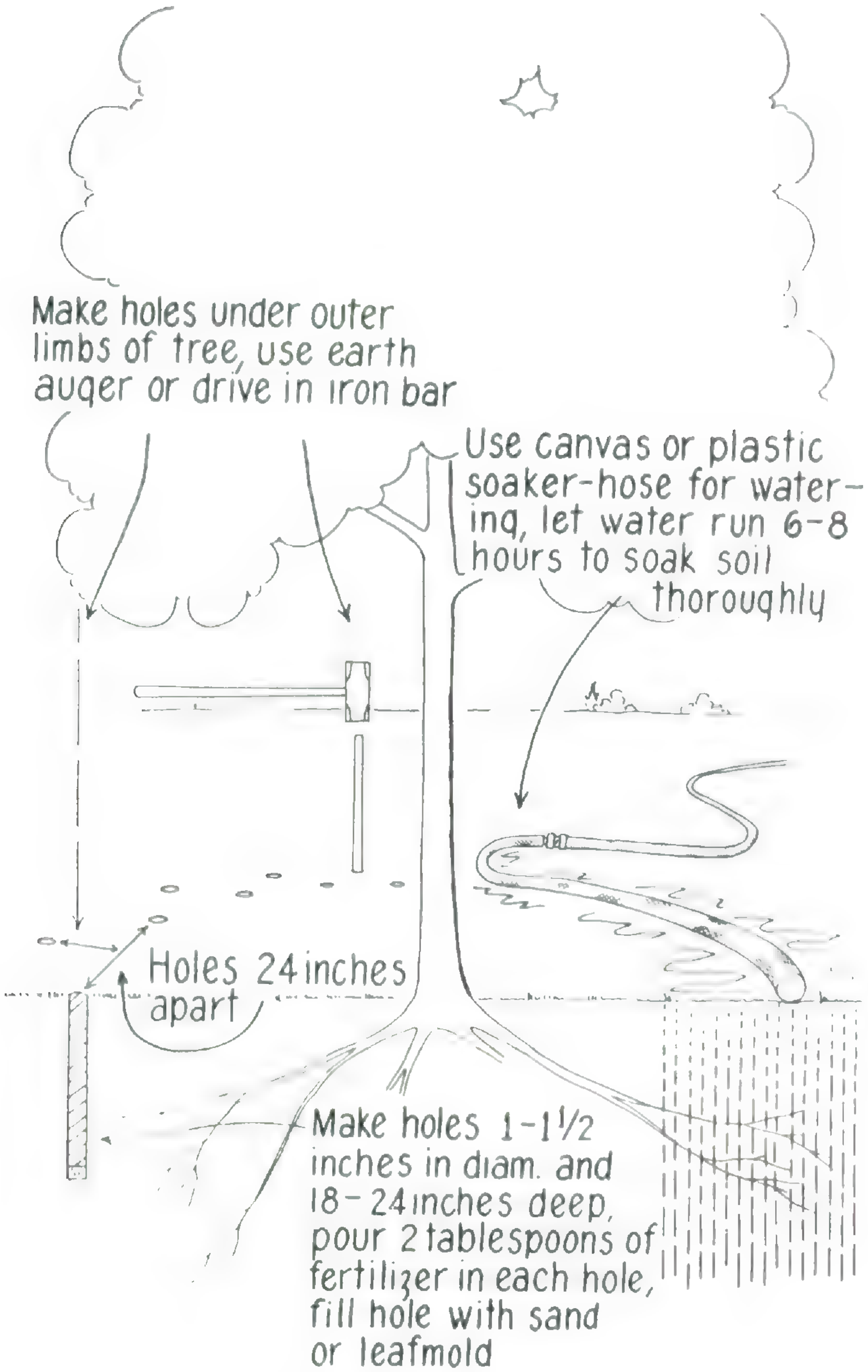


PROCEDURE FOR TREE PLANTING AND PRUNING

Left: step by step procedure for tree planting.
Center: limbs to be removed in order to grow stronger, healthier, and more shapely trees.
Right: procedure for removal of limbs 1½ inches, or larger, in diameter.

the fact that unplanted stock may be safely left for days or weeks before planting, provided it is watered occasionally. Unplanted balled stock may be held over for several weeks if soil or mulching material, such as sawdust, is heaped about the ball and kept moist. Some trees, Elm, Silver Maple, and Sycamore, are so easily moved that they are often sold "bare-rooted", that is, without soil about the roots. The added cost of buying trees either balled and burlapped or grown in cans should be discounted because such plants become established quicker than those moved with bare roots.

The secret of success with balled or canned stock is in the undisturbed contact of the root with the soil. Every precaution to prevent cracking or breaking of the ball must be taken when handling the tree. Having selected the site for the tree, dig a hole with a diameter 8 to 12 inches greater than the measurement across the ball at the base of the tree trunk, not more than one inch deeper than the depth of the ball. Careful excavation permits the ball to rest on solid soil and makes it easy to finish the planting job with the tree standing straight at correct depth. Lower the balled tree gently into the hole. *DO NOT REMOVE THE BURLAP WRAPPING ABOUT THE ROOTS.* Tree roots easily penetrate the burlap which decays rapidly. Trees grown in cans should be removed by slitting the can down the side from top to bottom; then tear the side of the can loose from the bottom to expose the plug-shaped mass of roots and soil. A pair of heavy leather gloves should be worn to protect the hands from possible gashes when removing the ball of soil and roots from the can. After the tree has been removed from the can it must be handled gently to prevent loosening the soil about the roots. Now with the ball placed in the center of the hole, lay a straight stick across the hole to check the planting depth of the ball. If the hole is dug to correct depth there will be no more than one inch between the stick and the top of the ball at the base of the tree. For trees having trunks one inch or less in diameter, this distance should not be more than one-half inch. Add a little soil about the base of the ball and make minor adjustments in straightening the tree, then carefully tamp the soil at the base using a piece of 2 × 2 or 2 × 4 lumber about five feet long as a tamper. Fill the remainder of the hole around the ball, alternately tamping and adding soil to about four inches from the top. At this point, if planting a balled and burlapped tree, the burlap binding should be cut loose at the top of the ball and layed back over the soil surrounding the ball. Add a small amount of complete fertilizer (one tablespoon for trees grown in one-gallon cans, a small handful for those grown in five-gallon cans or for burlapped balls from 12 to 24 inches in diameter). Wet down with a bucket or two of water, and after it has soaked in finish filling in soil about the ball. The excess soil that remains after planting should be used to form a shallow basin at the base of the tree to aid in watering it. Soak the soil about the newly planted tree by letting a hose trickle very slowly in at



Procedure for fertilizing and watering trees.

least four equally spaced positions about the hole so that all settling of soil will be equal and the tree will stand straight.

Watering.—Trees normally require great quantities of water if they are to thrive and make rapid growth. Fertilized trees must be given plenty of moisture to take full advantage of the added fertilizer. If during the growing season there has been no rain for over three weeks, the trees should be watered, especially newly planted trees. Watering can be done effectively with the soaker hose or an ordinary garden hose, with water merely trickling, laid on the ground beneath the tree branches. Trees, particularly those newly planted, should also be watered during dry periods of the winter months when the ground is not frozen.

Fertilizing.—The most rewarding work in tree maintenance is the simple procedure of fertilizing. Well-fed trees are least susceptible to the ravages of insect pests and disease. Certainly faster growth, darker green foliage in summer and more brilliant leaf color in autumn is worth the small effort required in tree feeding. Standard commercial fertilizers are excellent for trees. They are usually sold in granular form packed in 25-, 50-, and, most commonly, 80-pound bags. There are several different formulas represented by three numbers (example 10–10–10) which refer to per cent by weight of the three most important constituents—nitrogen, phosphorus, and potash in that order. For trees, formulas of 10–8–6 and 10–6–4 have been found to work best; but good results can be had with 10–10–10 and 8–8–8. Larger numbers in the formula indicates an increase in the strength of the fertilizer, therefore, less of the higher percentage fertilizer must be used or there will be danger of injuring the trees. Unless the gardener has a good understanding of the use of chemical fertilizers, it will be safer not to use formulas having numbers above 10 or 12. The procedure used in applying the fertilizer is simple. Using an iron bar approximately one inch in diameter and three to four feet long, sharpened to a point on one end (an old automobile axle is excellent) punch holes into the soil about 18–24 inches deep and 24 inches apart in a circle about the tree beneath the outer tips of the branches. A single circle of such holes is sufficient for trees having trunk diameters up to three and one-half inches. For larger trees, up to six inches in diameter, a double row of holes spaced 24 inches both ways will be necessary; and for trees ten inches or more in diameter, at least a triple row of such holes will be required. Pour a small handful (about two tablespoons) of the fertilizer into each hole. If desired, the holes may be filled with soil or a mixture of peat or leaf mold and soil; however, if the soil appears compacted they may be filled with sand or pea-sized gravel which will permit water to soak quickly into the soil about the roots. Fertilizing of trees is best done in late February to the first of April. If there is not sufficient rain (at least $^3/_4$ inch) soon after fertilizing, the soil should be soaked in order that the fertilizer be dissolved and distributed to where it can be taken up by the tree roots.

Pruning.—Through careful and thoughtful pruning of a young tree the gardener can control its branching pattern and correct many faulty growth habits that may lead to serious maintenance problems as the tree matures. Most trees are well trained when received from the nursery and need only enough pruning to balance the crown of the tree with the root system which has been reduced through digging the tree from the nursery row. Newly planted bare-root or balled-and-burlapped trees should have most of the limbs shortened approximately ⅓. Trees grown in cans will need little shortening of limbs because few of the roots are lost in moving. The young tree should be trained to a single straight trunk with side branches extending as nearly straight out from the trunk as the habit of the tree will permit. Trees with horizontal branches are most able to withstand strong winds and the weight of ice. Nearly every tree will require some pruning at one time or another during the year. Attention given to the young twig may prevent removing a large limb later on. A branch that rubs against another should be removed because the chafing that occurs during strong winds prevents the formation of bark and the limbs will easily decay. Most trees can be pruned at any season; a well-known exception is the maple which should be pruned in the fall or early winter and not from mid-January through May for the wounds will bleed freely during this time.

Insects and Spraying.—Most tree diseases are easily prevented by keeping trees healthy and growing vigorously. However, this will offer no security from insect attack although it will permit the tree to recover rapidly after serious ravaging by insects. Except the wood-boring beetles, insects often find the leaves and rapidly growing succulent shoots of healthy trees a choice source of food. The insects that usually cause damage to shade trees are divided into four groups.

Borers often damage newly planted trees which are suffering from the shock of moving and are not making rapid growth. In a healthy tree the borer may be sealed into its burrow by the rapid growth of bark over the entry causing the borer to suffocate. Borers may be located by the entry holes on the lower portion of the tree trunk. They are usually killed by squirting carbon bisulfide into the hole and sealing it with putty or wet clay. Spraying uninfected trees with a DDT emulsion is a good preventative for borers.

Chewing Insects cause serious damage to shade trees because they reduce the leaf surface area vital to healthy growth. The presence of chewing insects is indicated by the leaves having portions missing around the outer edge. Some chewing insects eat away the softer portions of the leaf leaving only the veins and stem. Stomach poison syrays such as arsenate of lead and DDT are good insecticides for chewing insects.

Sucking Insects, such as red spiders, aphids, thrips, and leaf-hoppers, often do more damage than chewing insects because being so very small they frequently go unnoticed until the vigor of the tree is greatly reduced. The gar-

dener will do well to learn to recognize these and other common insect pests on trees. Sucking insects usually cause a malformation of the leaf or new shoot, or discoloration of the leaves. They are best controlled by the use of such contact sprays as nicotine sulphate, DDT, and sprays having pyrethrum or rotenone as the active ingredient.

Scale Insects, although sucking insects, are considered separately since they require special treatment. They are difficult for the novice to discover on trees for they are flattened and have much the same appearance as the bark. When present in quantity they may be scraped from the bark. They often give off a pungent odor when crushed. While scale insects are more easily seen in winter they continue their damage through many months of the year and should be treated before they get a headstart. A dormant miscible oil spray applied in the winter months may be used.

Small trees, those 20 feet or less in height, may be easily sprayed using the standard 1½- to 3-gallon, hand-pumped, pressure spray tank. A nozzle that can be adjusted from a fine spray to a strong stream will enable one to reach both lower and upper branches of trees. The fine spray gives more thorough coverage of leaf surfaces and hence more complete insect control. It is important to spray the lower as well as the upper surfaces of all leaves. Power-driven spray equipment is necessary for the control of insects in large shade trees, and a qualified tree spraying specialist is recommended.

SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. spring to fall and until six in the winter time though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission twenty-five cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The step-in gate (more or less concealed by the big Cleveland Ave. gate, 2221 Tower Grove) is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi which are at their best in April.

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Tuliptree

Sycamore

Sweetgum

Zelkova

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Linden

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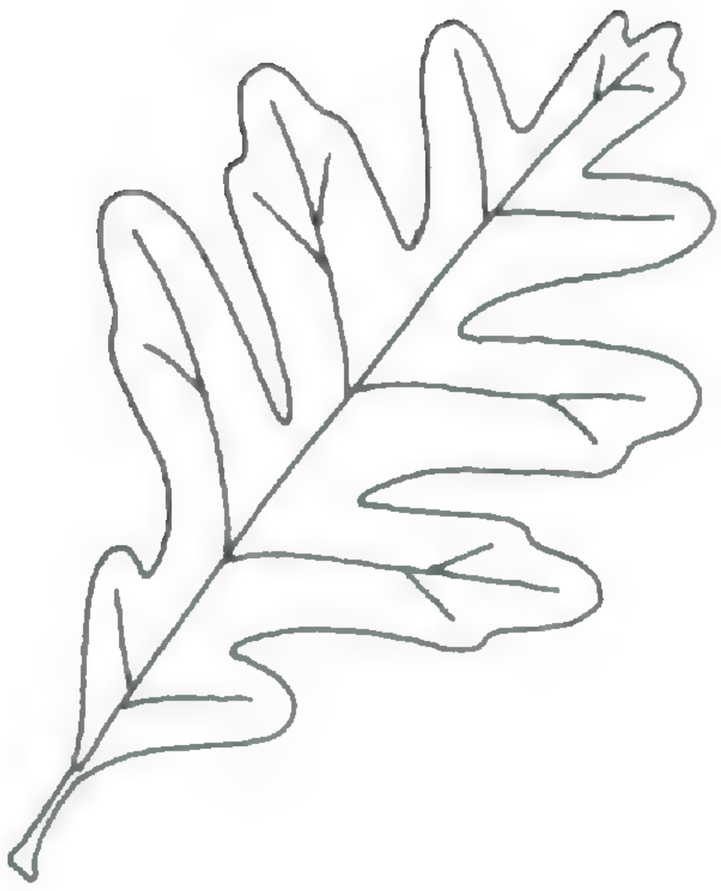
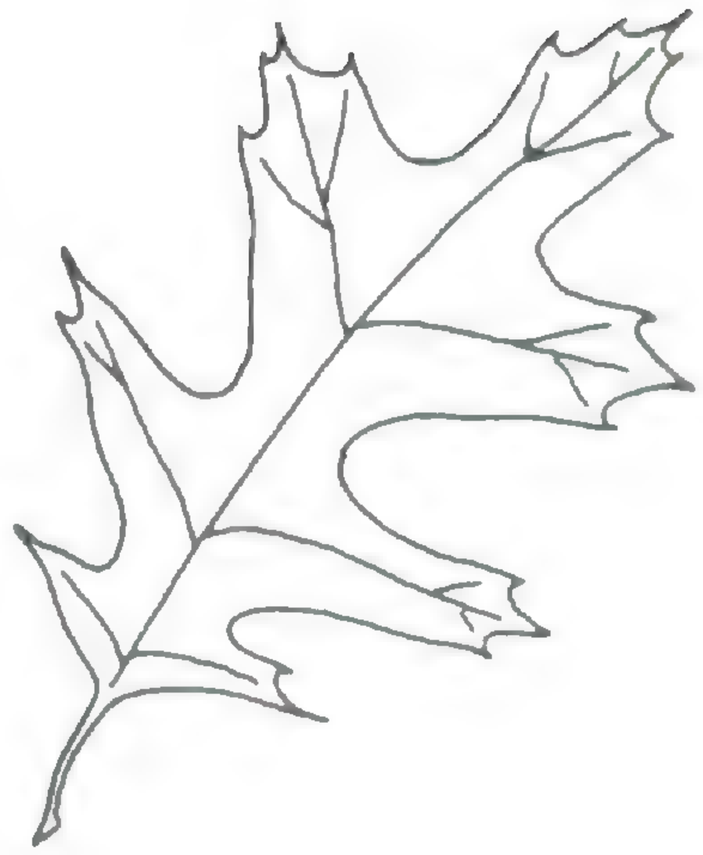
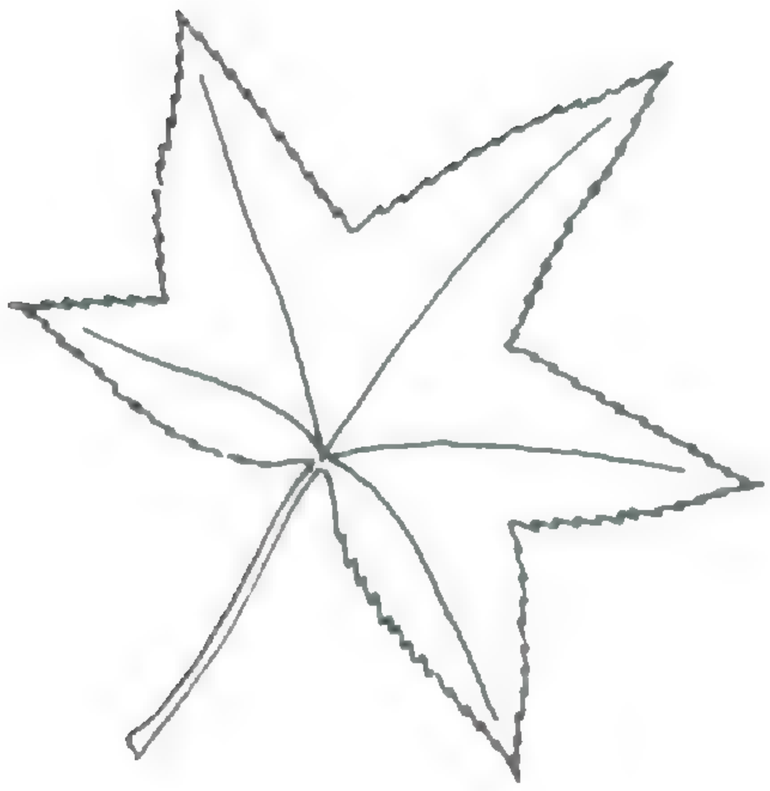
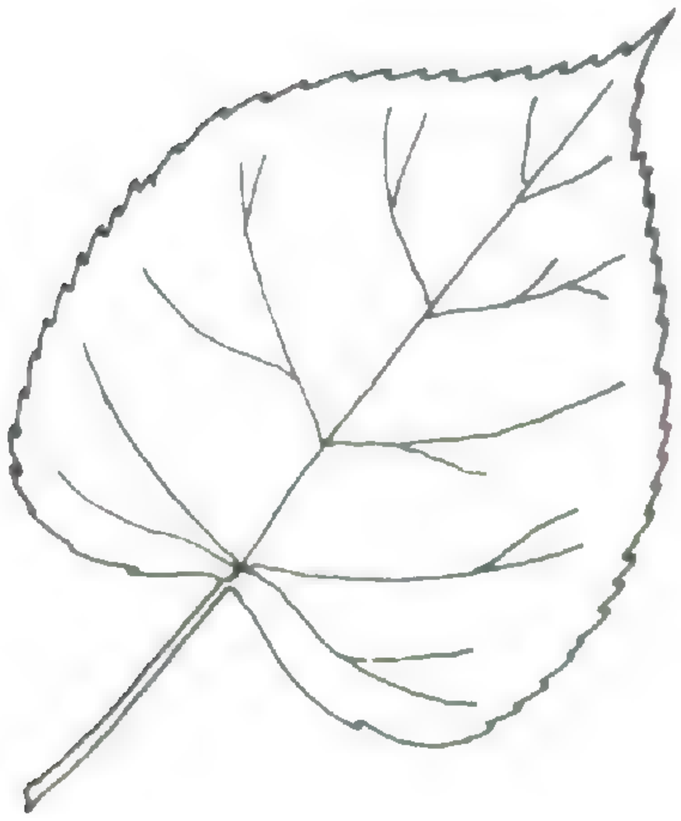
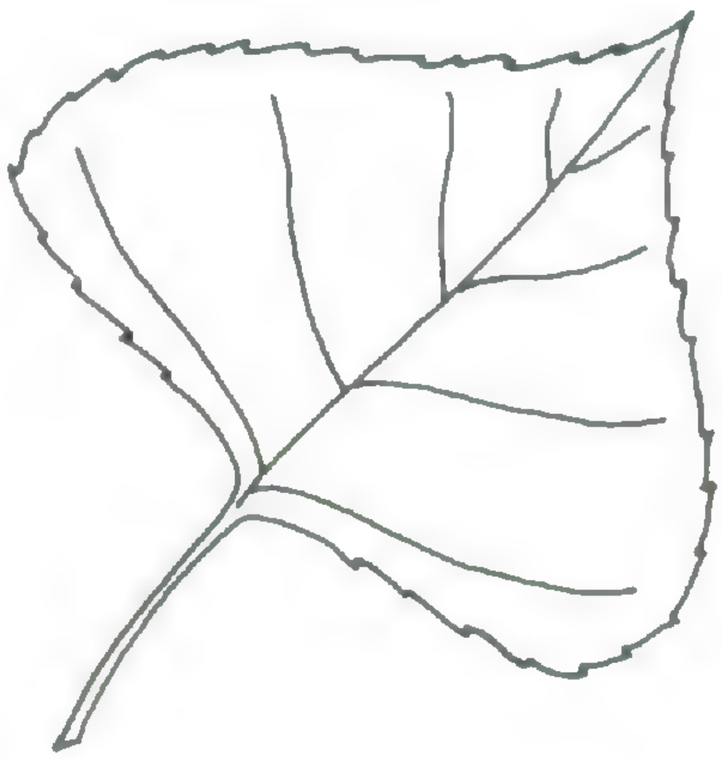
London Planetree

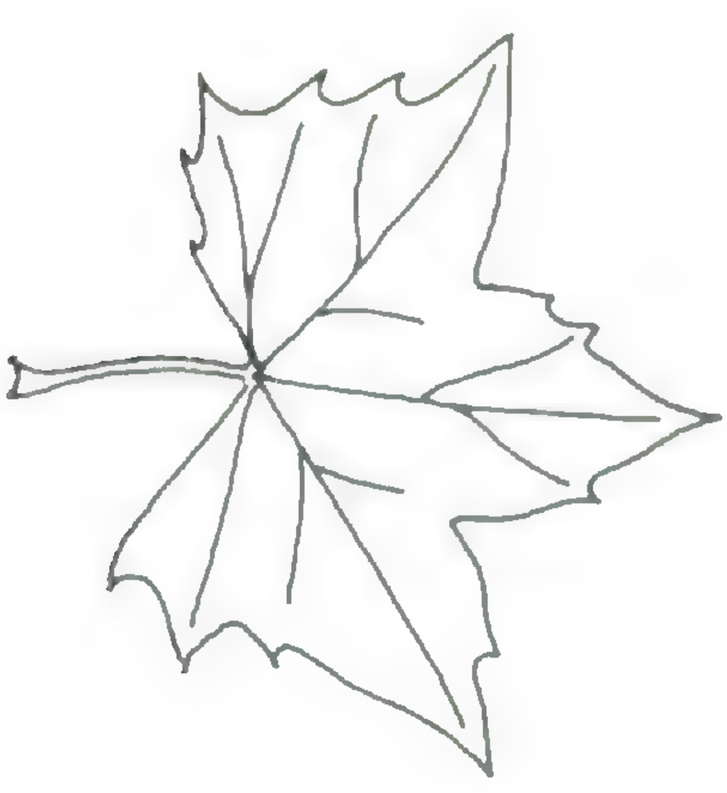


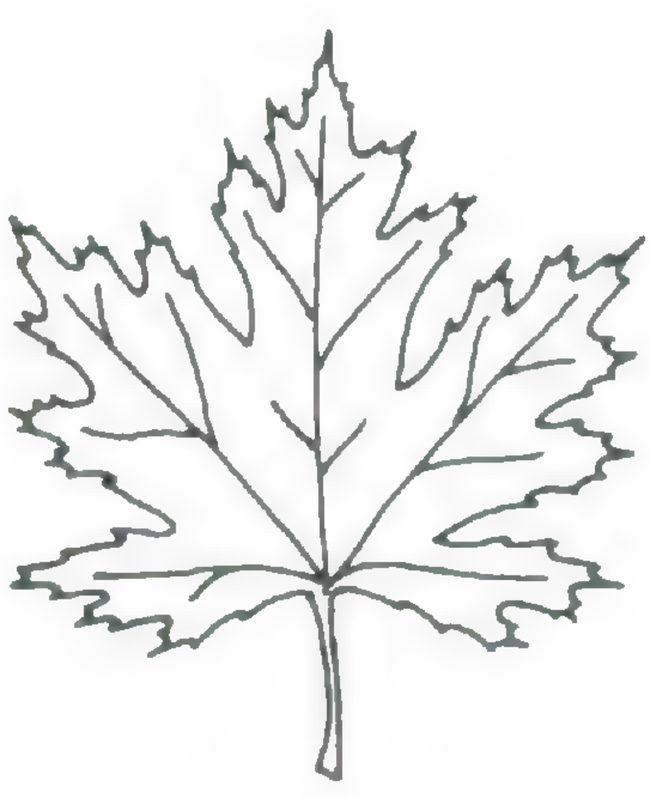












MISSOURI BOTANICAL GARDEN BULLETIN

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PATIO GARDENS

LADISLAUS CUTAK

In Mexico, even the humblest of dwellings has a patio—a courtyard surrounded by the walls of the house. The living rooms of the family are usually on the first floor, with the sleeping quarters opening on a second-story balcony which overlooks the courtyard. The balcony is supported by wooden posts, sometimes ornately carved, or by marble or cement columns. The areaway beneath the balcony is paved with brick, stone or sometimes tile, and is equipped with tables, chairs and benches. Frequently, bird cages and baskets of plants—orchids, bromels, and ferns—are hung around the outer edges of the balcony.

The patio itself is paved, usually in a different design from that of the walk beneath the balcony. The patio can be and usually is decorated with plants in a variety of homemade containers that can be shifted about to produce different effects. Soil beds, often raised slightly above the floor and filled with either flowering or bright-foliage plants, may be arranged in geometric patterns about the court. The center is marked by a circular flower bed, a pool, a fountain, a statue on a pedestal, or some other ornament; although a pool or fountain seems to be the basic centerpiece associated with all patios, large or small. The walls of the pool may be only a few inches in height, or at times as much as a foot high, in which case plants are set upon the curbing. Some of the more ornate homes of the wealthy have a series of patios opening one into the other, connected by an arch or a door through the wall. These passageways lend an old-world atmosphere to the beauty and cloistered serenity of the brick-walled garden.

The patio is a perfect link between house and garden. The editor of a well-known magazine *(Flower Grower)* calls it a unifying device because such an area itself is a wedding of the house and garden, being both an extension of the living quarters to the out of doors and of the garden into the house. It offers peace, quiet, and privacy. Even if built in the noisy business section of a modern city such a garden shuts out the loud noise of a hustling world. In some of our southern towns one may find restaurants, small hotels, and offices, especially medical offices, built around patios. However, patios need not be confined to any particular locality. In modified form they can be adapted to almost any part of the United States. They need not be enclosed entirely by the house walls. Some have the house on two or three sides with a high fence, or a hedge, completing the enclosure. In all cases, the patio brings

the garden into intimate contact with the house and makes it a part of daily family life.

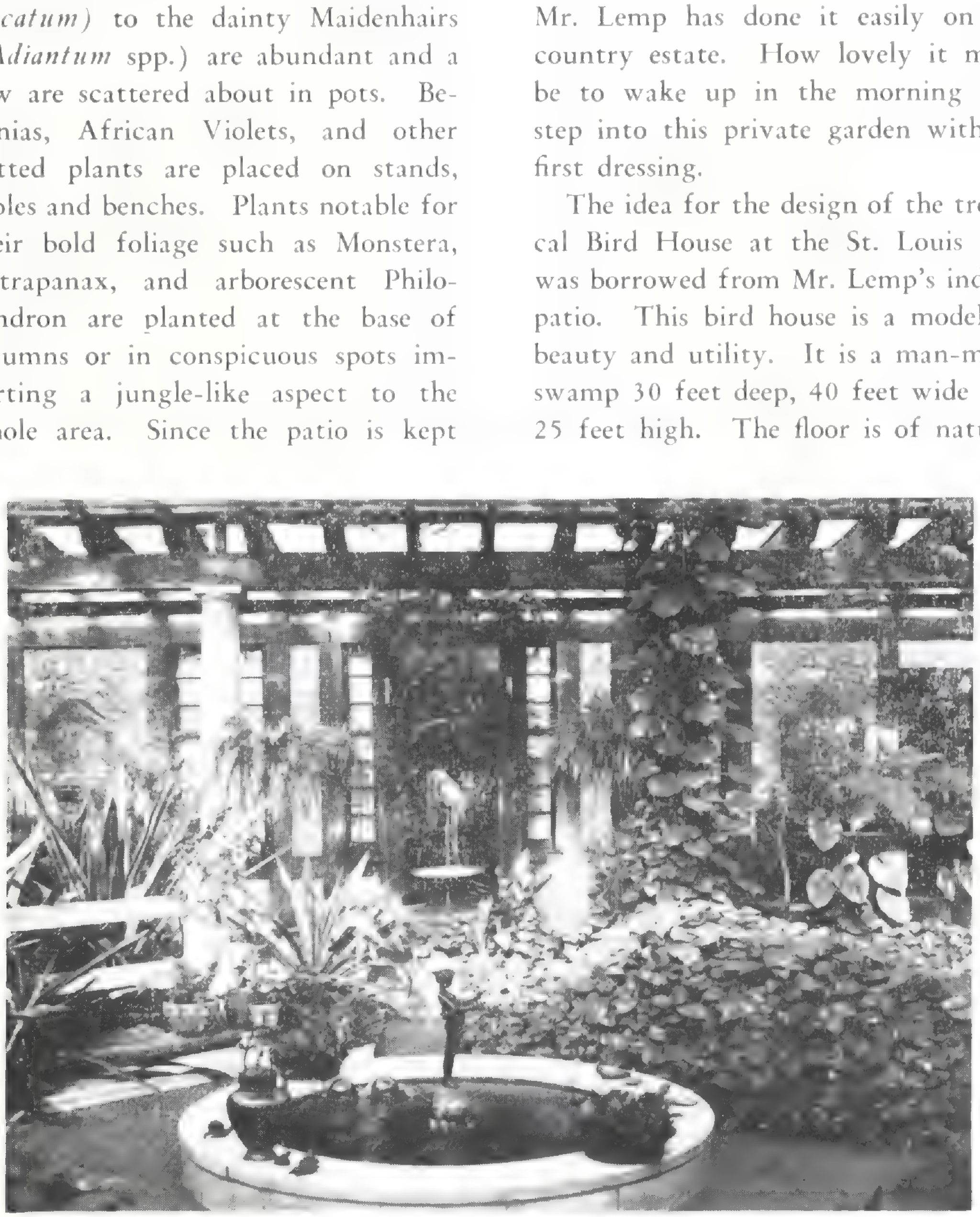
One will find patios in Mexico, southern France, Spain, Latin America, and in fact most regions where Spanish architecture and influence still prevail, as in southern United States. The charm of small patios is nowhere better exemplified than in the French Quarter of New Orleans. I was amazed at the delightfully colorful courtyards that exist behind the drab walls that are seen from the streets. The visitor to the Crescent City will get only glimpses of the lovely patios through locked gates unless he has friends living there or happens to be present during the Spring Fiesta when some of the charming homes and patios are opened. In some courtyards tall trees provide shade and there are Bougainvilleas and other tropical vines trained against the walls to impart a dash of color. Sometimes the walls are clothed with espaliered citrus trees on which both fruit and flowers appear. Also, ivies cling tenaciously to the rough walls and climbing aroids such as *Monstera deliciosa* (Swiss Cheese Plant) and *Scindapsus aureus*, along with Syngoniums, make striking wall-covers. A clump of bananas may be found in a corner with smaller-growing large-leaved plants like Strelitzia, Heliconia and Alpinia forming a background for ferns and crotons of every hue. Oleander and Hibiscus are either planted in tubs or directly in the soil. In addition, there are many flowering and foliage plants that fit into the *décor* of a patio.

To our neighbors below the Rio Grande, a patio is an integral part of every hotel and home. The courtyards are beautifully planted and elaborately ornamented with various bric-a-brac which seem to fit into the general design. The climate is ideal and a great variety of plants can be used. In spacious patios, palms such as Washingtonias are often utilized. They may be seen towering 30 to 40 feet high, their bulky trunks draped with philodendrons or hung with flamboyant orchids and decorative species of bromels. Clay pots of every description, painted and unpainted, are filled with sweet-scented Gardenias, Lantanas, Verbenas and bulbous Lilies and Amaryllis. Tinkling fountains add to the charm and harmonize with the songs of caged and wild birds that nest in the patio trees.

Although patio gardens are more suited to warm climates, I shall attempt to show that they are practical even in our Midwest. I know only one in the St. Louis area that has all the charm of the tropical ones. It belongs to Mr. Edwin Lemp whose home is situated high on a bluff of the Meramec River overlooking Sylvan Beach. Mr. Lemp, by erecting a glass roof over his patio which is entirely surrounded by the living quarters, has produced a climate such as that found in a greenhouse. A circular pool containing aquatic plants and a tiny figurine occupies the center of the patio. Large flower beds are built into the corners where permanent plantings include some of the choicest foliage plants available. One bed is entirely given over to succulents—mostly Sansevierias, Agaves, Gasterias, Pedilanthi,

and some Cacti. Another bed is completely covered with lush growth of *Scindapsus aureus* which also clambers up a column to the rafters above. *Spathiphyllum Kochii* with coriaceous, shiny, oblong-lanceolate leaves is used extensively as a border and in other beds. Different kinds of Ferns from the common house Holly *(Cyrtomium falcatum)* to the dainty Maidenhairs (*Adiantum* spp.) are abundant and a few are scattered about in pots. Begonias, African Violets, and other potted plants are placed on stands, tables and benches. Plants notable for their bold foliage such as Monstera, Tetrapanax, and arborescent Philodendron are planted at the base of columns or in conspicuous spots imparting a jungle-like aspect to the whole area. Since the patio is kept fairly moist and warm all year round it is possible to keep and grow a number of ornamentals which would not thrive in cooler and drier surroundings. Mr. Lemp also is interested in birds and has several colorful cockatoos on perches in the patio. It is nigh impossible to transplant a Mexican patio outright into our Midwest, but Mr. Lemp has done it easily on his country estate. How lovely it must be to wake up in the morning and step into this private garden without first dressing.

The idea for the design of the tropical Bird House at the St. Louis Zoo was borrowed from Mr. Lemp's indoor patio. This bird house is a model of beauty and utility. It is a man-made swamp 30 feet deep, 40 feet wide and 25 feet high. The floor is of natural



Atmospheric conditions, such as found in conservatories, permit exuberant growth to develop in the indoor patio of Edwin Lemp's home on the bluffs of the Meramec near St. Louis.

earth in which tropical and sub-tropical trees and shrubs are planted. There are pools bordered by rocks and plantings of hardier types of foliage plants. Fifteen to twenty species of birds have the freedom of the area; the plants which are damaged by the birds must be replaced frequently. It is another good example of an interior patio which can be used as a model in hotels, apartments, hospitals and even modern office buildings in the North and Middle West. In these enclosed patios, there is an infinite variety of tropical plants which can be used to good advantage. The enclosed patio is likened to a conservatory and will require identical care and maintenance.

One need not have a tropical greenhouse-type patio in the Midwest. Although the use of winter-hardy plants and the extreme effects of seasonal variations will make the patio a departure from the southern garden, nevertheless the patio-atmosphere can be obtained. One St. Louis landscape architect, Robert E. Goetz, who has planned and produced many nice patios for outdoor living in the Greater St. Louis area, specializes in a modified form of patio garden to fit contemporary homes. Mr. Goetz believes that a patio-garden is not only enjoyable and livable because of the pleasure the plants give, but it is an easy, convenient way to garden. He further states that when plant beds are built into the actual patio area and surrounded by permanent edgings such as brick, stone, or corrugated asbestos, the plants are accessible. The permanent edgings make it possible to mulch deeply, thus adding to the happiness of both plants and gardener by eliminating weeds, keeping the soil cool, and conserving moisture.

Patio of Mr. O. E. Goetz designed by Mr. Robert E. Goetz. Photo courtesy Mr. Robert E. Goetz.

Mr. Robert E. Goetz with his family at home in the patio which he designed. Photo courtesy Mr. Goetz.

Home-owners with modest budgets and a little talent can build a patio-garden for about one-third to one-half the cost of a professionally built one. However, my advice would be to pay the comparatively small fee a competent landscape architect charges for designing a garden. With his knowledge of engineering, building materials and plants he can not only create a beautiful and functional garden but probably also save the home-owner many costly mistakes.

In the contemporary patio ivy can be trained to creep upon the enclosing walls and fences. Trellises for climbing roses can also be set at intervals against the walls to hide the bareness. Evergreen shrubs with good substantial green foliage are always desirable—the Hollies and Mahonias are excellent material. *Ilex cornuta* 'Bufordi' with its large, glossy, deep-green foliage is a fine ornamental which can grow in sun or shade. A slow-growing Texas Barberry, *Berberis trifoliolata,* merits a trial if you desire something rare in this climate. It is a compact shrub with thick rigid leaves of greenish grey, with long spines or teeth on the edges. I have grown it for 15 years in my backyard without it ever freezing to the ground. Many other hardy plants are adaptable to the patio garden and gardeners with knowledge of and experience with the Midwest plants will have preferences of their own.

A contemporary patio garden in this area need not be devoted strictly to hardy plants; although, I must admit, it might prove more economical. The inclusion of several tropical plants will greatly enhance a patio. When a pool or fountain is included, aquatic plants

could be allowed to adorn the surface of the water; Water Lettuce, Water Poppy, Water Hyacinths and Parrot's Feather are ideal for the purpose. If a pool or fountain is not desired, a raised bed for flowers is recommended. A tree can be planted in a square or circular hole provided in the paving and tropical epiphytic cacti and other shade-loving plants can be suspended from the trunk and branches during the summer. Oleanders, Hibiscus and Ficus, in tubs mounted on castors, are also advocated for the patio.

Another Goetz-designed patio. Photo courtesy Mr. Goetz.

ONE WAY TO CONTROL DANDELIONS

G. H. BISHOP*

THE FOLLOWING procedure does not claim to eliminate dandelions; but it will enable you to hold your own against them and the dandelions will hold their own against you so that the battle with them will finally come to a draw. Two principles are fundamental: any dandelion that blossoms, dies; and, no dandelion goes to seed on your domain.

So, you get (1) a six-quart sprayer and put a three-foot rod on it with an ordinary spray nozzle on the end (to enable you to reach the ground without stooping), (2) a gallon oil can with the top cut out, and (3) a can of

* Dr. Bishop of the Department of Neurology and Psychiatry at Washington University School of Medicine is an excellent amateur gardener and we are impressed with his stimulating method of controlling dandelions.

2-4-D concentrate. Into the gallon can put one tablespoon of kerosene or furnace oil (modern fuel oil is the refuse from gasoline as sausage is from porkchops; but at least it is still greasy, and it sticks to dandelions like a stray dog to a garbage can), one large tablespoon of Ivory soap flakes, four to six tablespoons of 2-4-D, and fill with water, preferably soft and warm. Dump the mix into the sprayer and pump up to only moderate pressure and you're set. Ignore instructions on labels, for they give somebody else's methods. Don't drench the dandelions: one brief shot from the nozzle trigger held three inches above the weed and that plant will surely die. And don't hit anything else; this is strong medicine! When you can spray wild garlic out of the lily patch you have acquired the technique; but it is cheaper to try your practice shots among the shrubbery.

Now prepare a large paper sack by rolling the edge so it won't tear when you slap the mosquitoes and jerk it. Grasp the carrying handle of the sprayer with four fingers, the edge of the sack between thumb and handle, the nozzle wand with the other hand, and squirt a fine spray on each of the first five dandelions you meet. Then drop the nozzle, slap the mosquitoes, and bend your proud back to pick off every yellow head from those five plants and put them in the sack. Proceed to five more until you have them all. Repeat every other day until no more yellow heads appear, even on the plants sprayed last time—they can make seed even when sick. The first five years are the hardest for by that time you will have reduced the population to a manageable level.

To accomplish a comparable job by spraying all over is more expensive, is impossible where there are other plants, kills clover in the lawn, is less effective, lacks the personal touch and fails to satisfy the urge to kill; besides some of the dandelions will elude you and go to seed anyway. Every seedhead that blows away is a job for next year and you can rely on your neighbor's dandelions to keep you sufficiently supplied. After five years of slaughter, the yield should be about two quarts to a gallon of spray every half hour (if you are a spry walker) from an acre of ground—with the average neighbors.

The best time to hunt dandelions is when the mosquitoes are biting, which at this time of the year is between six and eight a. m. sun time. Some people can fool themselves that they are saving daylight by setting their clocks ahead; but nobody, except Joshua, ever stopped the sun and you can't fool the dandelions. These same people think mosquitoes bite in the evening; but that is when they are tired and are just looking for a nightcap. Breakfast is their heavy meal. You will need boots or to go barefoot for the dew is heavy and the gray heads shed their seeds when they dry out. This is also the ideal time to play golf, and slaying dandelions relieves you of that obligation. You get the pleasant walk, the fresh air, and the bird songs. Also, stooping to pick heads is as good as looking for golf balls in the tall grass and is a lot cheaper and gives you something for your money. If your

back recovers in two days so you can do it again you don't need a doctor. It will keep you savagely busy mornings until the mornings are so hot you wouldn't play golf anyway; but this is as far as this method goes. If you have dandelions you will have other things to do later such as watering the grass and killing moles. Incidentally, while one can trap moles, sitting on the grass with a cool drink waiting for them to wiggle, then digging them out appeals to some people especially after dandelion time when it really gets hot. This offers a continuing opportunity to further exercise your aggressive instincts without alerting the police.

Killing dandelions is one of the best ways of enjoying your landscape. You see it in detail repeatedly and really get acquainted with it. You can combine dandelion-slaying with bird-watching which may justify the latter (the Forest Park police once arrested an early-evening bird-watcher for snooping in the bushes and charged him with disturbing the peace); but I find that most of the birds get along all right without being watched. On your travels you will meet wild onions, yellow dock, chickweed and plantain, not to mention horseweed and wild lettuce, and other enemies which you can take a shot at in passing; but no need to stoop over to pick the flowers for they won't go to seed before they die. I find it helps to name various weeds by names of people I don't like. A passing shot is equivalent to a sneer. But dandelions are my dish; I just call them *Hoi polloi*, *canaille* or other terms of general disapproval. One has to get more or less personal to make this method work successfully and a good strong expression of animosity helps keep up the morale. I save my best invectives for those gray-headed *so-and-so's* that have already shed some seeds—those I missed the last time. Even as in golf, you have to keep your eye on the ball to make a perfect score.

But, of course, most people, especially the neighbors, won't take the trouble. This is why there are so many dandelions.

MISSOURI OZARK PLANTS IN ILLINOIS

ROBERT H. MOHLENBROCK

Butler's Quillwort

Although the unique Ozarkian flora is confined chiefly to a wide band extending from near St. Louis southwestward through Missouri and into neighboring Arkansas and Oklahoma, a few species have managed to cross the Mississippi River and make themselves rare members of the western Illinois flora. Some of these are in such a tenuous position that only one or two plants are known to exist in Illinois. For the most part, Ozark species had not been found in Illinois until recent years when more intensive collections were begun.

On some of the limestone glades throughout the Ozarks, a peculiar plant about five to ten inches high is occasionally found. From all outward

appearances, it looks to be a juvenile grass or sedge which has found a moist depression to its liking on a small ledge. However, if the plant is removed carefully from the thin soil, at its base will be found a two-lobed corm bearing roots. Near the base of each grass-like leaf is an inflated area in which may be found many extremely tiny spherical spores. This spore-bearing plant is related to the ferns, a fern-ally, and is known as *Isoetes butleri* or Butler's Quillwort, from the similarity of the leaves to a quill. It appears during March and by the middle of June it usually has disappeared completely.

This species was unknown to Illinois until one brisk morning in April 1953, when Dr. John W. Voigt, ecologist at Southern Illinois University, spied a little grass-like plant growing in moist depressions of a bluff at Giant City State Park in Jackson County, Illinois. On close examination this remarkable plant turned out to be Butler's Quillwort. Since that time, Dr. Voigt and I have discovered this fern-ally in four additional places in southern Illinois. It is interesting that all locations on which it is found in Illinois are St. Peter sandstone rather than limestone; however, it may be that the sandstone regions in Illinois have moisture conditions similar to those of the limestone glades of the Ozarks.

Flower-of-an-Hour

If you happen to be exploring on exposed sandstone bluffs or limestone glades in the Missouri Ozarks some summer afternoon between one and four o'clock, you may find yourself suddenly surrounded by curious little plants with bright pink flowers. The flowers are borne in clusters atop a slender stalk which arises from a clump of narrow succulent leaves. The plant, *Talinum calycinum*, is called Flower-of-an-Hour because each flower opens for only a few hours in the afternoon. Although looking like a typical desert plant, it actually belongs to the same family (the Portulacaceae) as our very common Spring Beauty (Claytonia)

Flower-of-an-Hour. Photo courtesy Dr. J. W. Voigt, Southern Illinois University.

and the Moss Pink *(Portulaca grandiflora)* which can withstand heat and drought.

Flower-of-an-Hour was first known in Illinois in the fall of 1954 when I found a single plant growing in thin soil along the edge of a sandstone bluff known as Castle Rock. Castle Rock, an interesting formation which arises above the surrounding land, is located in Randolph County near Leanderville, some 60 miles southeast of St. Louis and scarcely 10 miles from Missouri. Hoping to find additional plants, I returned to the same area the week following my discovery and found between 150 and 200 plants, about half of which were in full flower! This is the only place in Illinois where Flower-of-an-Hour has been found to occur, although similar habitats seem plentiful.

Shortleaf Pine, with the author. Photo courtesy Dr. Voigt.

Shortleaf Pine and Harvey's Buttercup

On the morning of April 24, 1954, I was fortunate to be a member of a party of three who were botanizing a section of the state where they had not been before. The place was Piney Creek and was located near the small village of West Point, Illinois, in Randolph County. There was a particular reason for our going to "Piney" for, as the name indicates, pine trees occurred there, and in southern Illinois a pine tree is a rare thing! The Shortleaf or Yellow Pine is a species common to southern Missouri, but known in Illinois only in Piney Creek and in the Pine Hills of Union County. Because of the easy access to the Pine Hills, most naturalists in the area are familiar with the pines which grow there. Although for several years pines have been known to occur at Piney Creek they have been seen there only rarely due to the ruggedness of the area.

After leaving a country lane, we walked down a great rocky, exposed, south-facing slope to get to Piney Creek. We found the slope virtually covered by Bird's-foot Violet *(Viola pedata)*. Both kinds were there—the one with three pale-lavender and two purple, velvet-like petals was most common, although occasionally we saw the all-lavender variety. At this stage, Piney Creek was rather small with the violet-carpeted slope on one side and an open field on the opposite; but as we followed the creek westward, it took us the way it must have gone for

thousands of years as it cut its way through a tremendously large sandstone bluff. The creek itself has mostly solid rock bottom all along its course with occasional drop-offs of one to ten feet, at the bottom of which are shallow or deep pools of rather clear water. There are numerous "pock-holes" in the creek floor and here and there are long, deep grooves, as from the scratching of some giant prehistoric animal when the stream bed was still soft; and even in the middle of the summer there is often a little water in these depressions.

American Aloe. Photo courtesy Dr. Voigt.

Harvey's Buttercup. Photo courtesy Dr. Voigt.

As we walked along the narrow space between the creek and the bluff on our right, we observed on the ledges such species as the American Aloe or Agave *(Agave virginica)* and the Yellow Star-grass *(Hypoxis hirsuta)*. Finally we came to our goal—our first Shortleaf Pine! It was only about ten feet tall, clinging desperately to the side of a steep cliff. We searched the bluffs, which now completely surrounded us, for other pines; but, seeing none, we continued along the creek.

Then, quite by accident, I spotted a not too-unusual-looking buttercup growing among the Agaves near the base of a slope. When I examined it more closely, I realized it was a species I didn't know; and it was then for-

gotten in the vasculum or collecting can until I returned home, when I identified it as a new buttercup for Illinois. It was Harvey's Buttercup *(Ranunculus harveyi)*, an Ozark species known previously from southern Missouri, Arkansas, and Oklahoma. Later visits to Piney Creek rewarded us with many more plants of Harvey's Buttercup. More recently, it has been found by the author along Rock Castle Creek in Randolph County and near Ava in Jackson County.

After discovering the buttercup, we came to the most rugged portion of Piney Creek and were awe-stricken by several large trees of the Shortleaf Pine. These trees, many undoubtedly very old, were scattered along the cliffs ahead of us, and there was an abundance of seedlings beneath them.

In addition to the species mentioned above, a new sedge for Illinois *(Carex torta)* was found growing along the edge of Piney Creek. Subsequent visits to that area have produced other new plants for the state, including the very rare fern, Bradley's Spleenwort *(Asplenium bradleyi)*, and a wild blackberry *(Rubus alumnus)*. Many of these newly-reported plants are known to be common in the Ozarks.

Bird's-foot Violet. Photo courtesy Dr. Voigt.

THE GINKGO

AN ANCIENT TREE FOR A MODERN WORLD

R. L. SCHUMANN

THE GINKGO, a sole survivor of an ancient plant group, was apparently saved from extinction by a religion. Its relatives are known only as fossils and it has existed almost unchanged for so long that it is sometimes called a "living fossil". Thousands of years ago during the Triassic period (the age of the first dinosaurs) of the Mesozoic Era, the Ginkgo and

its relatives flourished. There are some indications of the group even farther back in the Permian period of the Paleozoic Era. As evidenced by the many fossils of Ginkgo occurring in Triassic and Jurassic rock throughout the British Isles, in Greenland, and in the United States, especially along the northern Pacific Coast, its distribution must have been quite extensive. Some of the fossil leaves have many lobes whereas the existing form is two-lobed; otherwise the ancient forms differed from the present-day Ginkgo only slightly. With changes in world climate, the Ginkgo retreated until only a small area served as its last stronghold. Groves of trees such as the Ginkgo, served as early temples and the Buddhist priests cultivated the Ginkgo in the temple gardens. This intentional propagation of the Ginkgo is apparently responsible for its continued existence, for, although eastern China seems to have been its last retreat, no wild stands have been found there. It was discovered in 1690 by Dr. Kaempfer, a surgeon with the Dutch East India Company, around these Buddhist temples.

The name Ginkgo, sometimes spelled Gingko, seems to have been coined by Kaempfer. *Yin-hing* is listed as a Chinese name; *yin* meaning silver and *hing*, fruit or apricot which the ripe seed somewhat resembles. It belongs to the Class Gymnospermae, Order Ginkgoales, Family Ginkgoaceae and is represented by a single species—*Ginkgo biloba*. Four varieties are recognized: *fastigiata*, with stiff erect branches; *laciniata*, with more deeply cut leaves; *pendula*, with weeping branches; and *variegata*, with poorly-marked yellowish stripes on the leaves.

In 1784 the Ginkgo was introduced into the United States. A tall tree, it frequently reaches 60–75 feet and there are accounts of specimens as tall as 100 to 120 feet. Its general appearance is somewhat similar to our conifers—the shape is conical and the horizontal branches arise in whorls. Young trees may be irregular but age brings more symmetry. These trees appear sparsely branched. Along the larger branches grow many extremely short branches or short shoots. From a

Ginkgo in winter, illustrating short-shoots.

terminal bud on these short shoots the new year's leaves emerge in clusters or swirls. Since there is practically no stem elongation, the short shoots increase in length from year to year only very gradually. Upon examination, the leaf scars of previous years are seen to be condensed as they are on the trunks of certain palms. Interspaced

at odd intervals on the branches are somewhat longer branches or long shoots. These long shoots continue to grow terminally for a number of years, but they produce lateral short shoots after approximately two years. Occasionally a long shoot will arise from the

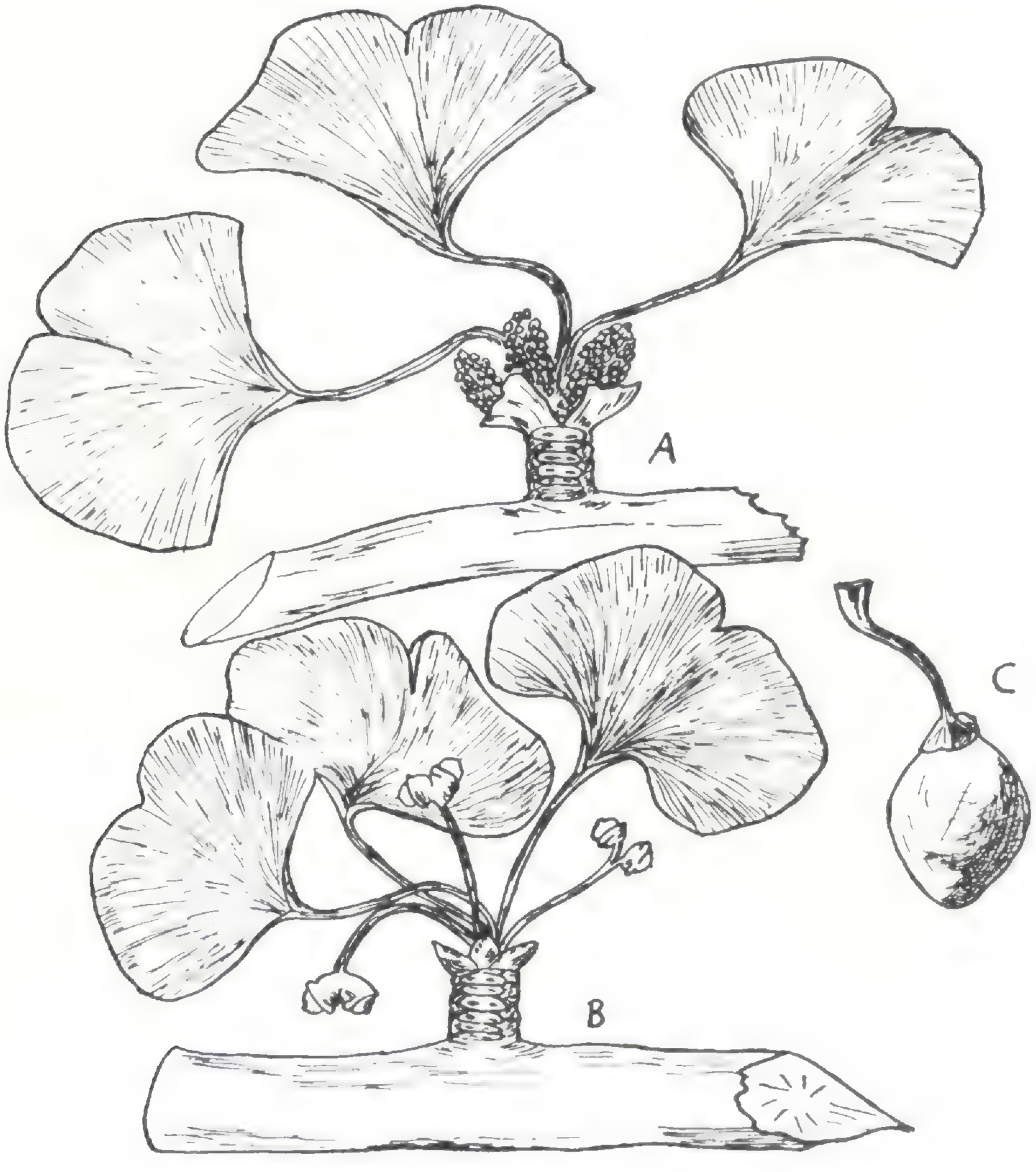
Main trunk of Ginkgo showing whorled branches.

terminal bud of a short shoot. The leathery, ribbed, fan-shaped leaves are similar to those of the Maidenhair fern from which the Ginkgo gets the common name, Maidenhair Tree. These light green leaves averaging 2–4 inches in width are longitudinally veined and cleft slightly at the apex forming a two-lobed blade. Although in general habit and appearance the tree resembles a conifer, unlike most conifers, it is deciduous, the leaves turning bright yellow in autumn. In late spring when the leaves are half grown, strobili, or cones may appear at the tips of short shoots. Male and female strobili are borne on separate trees. The male cones consist of many pairs of pollen-bearing sporangia called microsporophylls. The female strobilus consists of a small cluster of sporophylls each with two egg-bearing structures or ovules. Wind-borne pollen functions in fertilizing the egg within the ovule. Not infrequently both ovules will develop into seeds, although one usually aborts. The drupe-like yellow-orange seed (falsely called a "fruit" because of its fleshy outer wall) develops to about one inch in length. A high content of butyric acid in the fleshy layer causes it to become putrid. Notwithstanding this fetid odor the Chinese are noted to use its flesh in preserves and to serve it as an aid to digestion between courses at meals. The nut-like inner part is also considered a delicacy; when roasted it is said to taste like maize.

These trees are easily started from seed, and because of their tough seed-coat, stratification is recommended by some horticulturists. Since the seeds fall from the trees before they are fully mature, they will not germinate if planted immediately. Seedlings can be started in cold-frames or in other sheltered places. Some sources indicate that the trees do best in rather dry loam; however, they seem to do well in any relatively good soil. In dryer areas they may require watering. Varieties and definite sexes where one is preferred are best secured by grafting or budding. The grafting is done in the spring on seedlings raised in a warm house. After grafting, the plants should be frequently sprayed with water from above, and shielded

from the sun until a true union is made. Other methods of propagation which have been successful and which are more rapid are by layering and cuttings.

The Ginkgos are successful street trees since they are unaffected by air pollution. In addition to being easy to propagate they are easy to transplant, free from insect and fungus pests, long-lived, and, because of their moderately strong wood, are resistant to sleet and ice storms. On the other hand, they are extremely slow-growing.



A. Short-shoot with male cones. B. Short-shoot with ovules. C. A seed.

Male trees are usually preferred, especially for street planting, because of the objectionable seeds on the female trees.

Several beautiful specimens of Ginkgo trees may be seen at the Missouri Botanical Garden and in Tower Grove Park in St. Louis. Probably the most famous plantings of these trees are in Washington, D. C., where they line the walk in front of the United States Department of Agriculture. *(From a paper prepared for Mr. Robert Gillespie's class in Horticulture at Washington University.)*

BOOK REVIEWS:—

The Ferns and Fern Allies of British Columbia. By T. M. C. Taylor. British Columbia Provincial Museum, Handbook no. 12. Victoria, B. C., 1956. 50¢.

Ferns of the Ottawa District. By W. J. Cody. Canada Department of Agriculture, Ottawa, 1956. $1.00.

Ferns and Fern Allies of Texas. By Donovan S. Correll. Texas Research Foundation, Renner, Texas, 1956. $5.50.

EACH OF these three books can be highly recommended as a reference or for use in or near the area covered. The first two are essentially pocket field guides and provide the means for easy identification of the species, and additional information about their distribution and habitats. They are both well illustrated. The third is more pretentious, following the format of the Flora of Texas from which it has been reprinted with the addition of an excellent introduction. It is a more technical treatment, including specimen citations, lists of synonyms and quite detailed descriptions; but the fine illustrations, the keys and the discussions will make it equally useful for the non-professional person.

—Rolla Tryon

A Field Guide to the Ferns. By Boughton Cobb. Houghton Mifflin Co., Boston, Mass., 1956. $3.75.

THIS BOOK on the ferns and fern allies of the northeastern United States and adjacent Canada is an unfortunate addition to the Peterson Series, which otherwise has a wide and well deserved reputation for excellence. Neither does it do credit to the rapidly growing list of fern books intended in part or wholly for the non-professional user. The illustrations of each species by Laura Louise Foster and brief chapters on "Ferns in the Flower Garden" by H. Lincoln Foster and "Ferns and Their Allies in the Past" by Theodore Just are the only redeeming features. The illustrations are perhaps worth the price of the book but the user should be wary lest his attention be diverted to the keys or descriptions. Several introductory pages of keys to the species are largely based on such general and untrustworthy characters that it is hardly possible that these keys can successfully be used. The descriptive material for each species is not only inaccurate in many places but is replete with confusion introduced by the inexact and varying use of such words as "stem", "leaf", "leaflet", "axis" and "stalk" and the use of other words with no precise meaning in botany. In a recent review in the American Fern Journal (Vol. 46 No. 4) E. T. Wherry and C. V. Morton have pointed out a few of the many objections in detail and I will not repeat them here. One quotation from the text of the Royal Fern will suffice: "At a distance this fairly common large fern is distinctly fernlike in appearance, but close up, its widely spaced, oblong leaflets make it look like a locust tree." I doubt that anyone, even the author, would ever seriously confuse the two. —Rolla Tryon

Gardening Indoors Under Lights. By Frederick H. and Jacqueline L. Kranz. 241 pp. 1 color plate, 25 plates, 12 figs. Viking Press, New York, 1957. $4.95

MUCH sound information annoyingly hidden in a maze of text. The style is easy, informal, and pleasant to read; but the material seems to be loosely organized and a bit difficult to get at. Sound advice based upon the experience of the authors and/or upon well qualified references is to be found throughout the book, but it is up to the reader to jump about, record the facts, and give them continuity. The plates—eight, by the authors—are good. The figures are clear and well done. The beginner can easily handle what technical material there is. The ability of a novice with tools seems to have been overestimated by the authors, for they make light of what will prove to be difficult work when the reader starts to build his plant case with pencil, square, saw, hammer and screwdriver. A book obviously for the eager novice, but containing much reference material useful to others, when they can find it. Nicely indexed, which helps.

—W. F. Scott

Plants Indoors. How to grow and arrange them. By C. R. Boutard. 254 pp. 57 plants illustrated. 10 full-page plates. 5 Tables. Putnam & Co., Ltd., London, 1956. 21 shillings.

THIS BOOK written for indoor gardeners in Great Britain is nevertheless most useful for America. Some of the suggestions must be passed over, for they are not valid in the average American home. Some of the recommended products are not on the American market. Some of the suggested plants are not readily available in this country. But the basic information is good. The illustrations are satisfactory. The full page plates depict situations more easily identified with Great Britain than with America, but they also present ideas which are universal in application. The five Tables alone would make the book worthwhile. Table "A" entitled "Guide for Indoor Plants" has 70 pages of information on diseases, propagation, cultivation, and country of origin of more than 170 house plants. Table "B" gives similar information on various types of begonias. Table "C" is on succulents, and Table "D" on ferns. Despite inconsistencies arising out of differences in materials and conditions here, this is a book worth owning.

—W. F. Scott

Botany for Gardeners. By Harold William Rickett. The Macmillan Co., New York, 1957. Price $4.50.

THIS BOOK grew out of a course given by Dr. Rickett at the New York Botanical Garden to a group of gardeners, nurserymen, teachers, housewives, etc. With his background of botanist, teacher, gardener, and artist Dr. Rickett is well-qualified to answer as simply as possible the questions usually put to botanists. As is logical, the first chapter begins with the seed —what it contains, how it germinates, how the roots find water, and finally the relation between growth substances (auxins) and weed killers. Other chapters explain such things as why

different plants may be propagated by different methods; the how and why, physiologically speaking, of pruning; the food of plants—why they need fertilizers and how they make use of it; the kind and purpose of flowers and "the way of a flower with a bee"; etc. One of the last chapters tells us about diseases of plants and their remedies, which necessarily includes something about fungi, bacteria and viruses. Dr. Rickett is a taxonomist and he explains the binomial system of naming plants in an appendix. Apparently, the layman can't get over the fact that the scientific name is the *real* name, and that the common names vary according to the locality. Anyway, he makes the binomial system appear simple and easily understood.

Dr. Rickett's book may not *make* more successful gardeners but it will certainly help the interested person who wants to know why and how plants and the growers of plants do this and that. The fact that Dr. Rickett knows gardening as well as botany is evident on every page. His enthusiasm is downright contagious, and one finds himself reading the book more as if it were a "story" than a textbook. —Nell C. Horner

Rauwolfia Botany, Pharmacognosy, Chemistry and Pharmacology. By Robert E. Woodson, Jr., Heber W. Youngken, Emil Schlittler, Jurg A. Schneider. 149 pp. 25 pp. illustrations. Little, Brown & Company, Boston, Massachusetts, 1957. Price $5.50.

RAUWOLFIA is one of those folk-remedies which, like Ephedra, has been used by "natives" for several thousand years and was only recently discovered by our medical men. The roots and leaves of Rauwolfia have long been used in India for the treatment of the bites of reptiles, the stings of insects, and for diarrhea and various other ailments. Within the last few years the plant has been used in one of the most talked-of developments in medicine, the tranquilizers.

This is a technical publication and another illustration of the wide field in which the Garden staff and students work. Dr. Woodson is a taxonomist, a specialist in naming plants, and the world authority on the Flora of Panama and on the milkweed and dogbane families. Rauwolfia belongs to the dogbane family and for several years Dr. Woodson has been studying the kinds of Rauwolfia for a large drug company. The first of the four chapters is Dr. Woodson's report; a very scholarly and readable one, for Dr. Woodson is one of those rare biologists who knows how to write well. He tells of the different species of Rauwolfia, their distribution, native uses and names, and how to identify the roots of some of the commonly available species. This is basic work, for a proper identification of the plant materials is essential before useful studies of the drugs can be completed or the raw materials obtained and standardized drugs prepared for the market.

The second chapter discusses the crude drugs of each of the common kinds of Rauwolfia and the other two chapters are on the chemistry and the effects of the Drugs.—Hugh Cutler

Corn and Its Early Fathers. By Henry A. Wallace and William L. Brown. 134 pp., 27 pp. illustration. The Michigan State University Press. East Lansing, Michigan, 1956. Price $3.75.

THIS IS AN unusual book for it combines botany, history, philosophy, and economics in one small well-written volume. The authors begin by telling what a corn plant is and then trace corn from its origin down to the present and go on to hint what the corn of the future might be like.

Henry Wallace was one of the first men to recognize the importance of hybrid corn and he played a large part in the development and spread of hybrid corn in this country. William Brown is the director of research of one of the largest hybrid corn companies. He is also one of the many graduates of the Henry Shaw School of Botany and the Missouri Botanical Garden who has become outstanding in his field. Dr. Brown's studies at the Garden were mainly on problems dealing with grasses and much of the work he does now is basic research, part of a long-range plan for improving the Americas' most unusual grass—corn. The authors collaborate well to give a dramatic history of the most important American corn plant and of people who worked with it.

—Hugh Cutler

The Complete Book of Greenhouse Gardening. By Henry T. Northen and Rebecca T. Northen. 332 pages, 20 pages of index. The Ronald Press Co., New York, 1956. Price $6.50.

ONE OF THE objectives set forth in the preface is filled in nineteen tightly written pages that give detailed suggestions for planning, building, and equipping a greenhouse. The next five chapters state the basic facts related to management of the greenhouse, soils and nutrition, growing plants from seed, and other methods of plant propagation. The following three chapters tell how to control shape, size, and flowering time of several kinds of plants. Since the greenhouse climate favors growth of certain plant pests, several kinds of insect pests are discussed in a chapter of 14 pages which includes line drawings of the thirteen insects that cause most of the grief, and tabulates the insecticides of value. Formulae for making from one to ten gallons of insect spray are given. There is also a chapter on the common plant diseases with a tabulation of twenty-four kinds of plants and the symptoms and methods of controlling the various diseases common to each.

Information regarding the production of both common and unusual cut flowers is discussed in separate chapters. For both, space requirements, the time to sow seed, and normal flowering times are given in concise tables. A chapter on pot-plants gives brief but pertinent information on sixteen different flowers ranging from the common Chrysanthemum to the less familiar, albeit good, greenhouse performers, such as Streptosolen and Grevillea. Pelargoniums, including some unusual geraniums, are covered in well-written detail and will add much to the knowledge of people who "have raised geraniums for years".

Just in case the greenhouse owner doesn't have his greenhouse bulging at

the seams with the plants normally known as greenhouse specimens, a separate chapter shows how well a greenhouse may be used to facilitate beautifying outdoor beds and producing "a variety of delicious vegetables". The last chapter tells of greenhouse-grown vegetables which the authors aver "are tastier than those purchased at the store". The several line drawings and tabulations in each chapter add to the completeness of the subject matter, for the amateur will surely appreciate knowing many details about several important plants, rather than to know less about more kinds. There are also several pages of excellent black and white pictures which illustrate many 'how-to-do' paragraphs.

The authors are at their best throughout most of the pages, as they state fact after fact in clear, easily understood language. Even in the chapter on Managing your Greenhouse the paragraphs are mostly facts, and only traces of theory and opinion can be found. They say definitely what most gardeners believe—"To grow plants to perfection nothing takes the place of human skill, care and judgment . . . raising plants then becomes an art, an opportunity for one to develop his own skill." This book was written by teachers who know their subject and pupils equally well. It is a good book in which to browse when one's greenhouse results are somewhat less than satisfying.

—C. Barbre

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. spring to fall and until six in the winter time though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission twenty-five cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The step-in gate (more or less concealed by the big Cleveland Ave. gate, 2221 Tower Grove) is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi which are at their best in April.

GROWING DAHLIAS FOR EXHIBITION AND GARDEN

MISSOURI BOTANICAL GARDEN

Price 25 cents

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Missouri Botanical Garden Bulletin

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GROWING DAHLIAS FOR EXHIBITION AND GARDEN

INTRODUCTION

It has been many years since information about Dahlia culture in the St. Louis area has been made available to the public through the Missouri Botanical Garden Bulletin. Since the Greater St. Louis Dahlia Society is host to the 24th Annual Midwest Dahlia Conference and Show, September 28 and 29, 1957, at the Missouri Botanical Garden, bringing visitors and growers from coast to coast to St. Louis, it was decided to feature dahlias and their culture in this issue. The following members of the Greater St. Louis Dahlia Society have contributed articles: Charles DuChesne, Ray Grass, Joe Goss, Mr. and Mrs. Paul Hale, Ray Horrell, Richard Jamison, Mr. and Mrs. William Knetzer, Jerry Ludwig, Dan O'Gorman, Ralph H. Rabenau, L. W. Reiter, Russell Tilley and Rolla Zufall.

Additional cultural notes have been taken from Dahliadel Cultural Instructions, from the University of Wisconsin Extension Service Circular 544, from the Dahlia Blue Book for 1957, and from previous issues of the Missouri Botanical Garden Bulletin.

HISTORY OF THE DAHLIA

Toward the end of the sixteenth century (1570) Philip II of Spain sent his physician, Francisco Hernandez, to New Spain (Mexico) to investigate the natural history of this country. As a result of this expedition, Hernandez published in 1615 four books on the plants and animals of Mexico in which he describes three forms of "an herb bearing leaves similar to the mountain spikenard (*Valeriana tuberosa*) which are divided into five leaflets of which some are sinuated. The flower stalks which are nine inches long are slender and smooth and the flowers pale red and stellate." The figures accompanying this description are easily recognized as a form of our well-known dahlia, although the plant had to wait 175 years for a permanent name. Hernandez called his three forms by their Aztec names, Acocotli, Cocoxochitl, and Acocoxochitl. Cocotli meant tube or hollow stem, and the native names may be translated as "water pipe," "hollow-stem flower," and "water-pipe flower," respectively.

Hernandez specifically states that there were many forms of Acocoxochitl occurring in Mexico. These differed from one another in size and color, "some white, others yellow, others purple or perhaps yellow tinged with purple, and a great many other kinds, in some cases with double or multiple whorls of ray flowers, either forming circles or clustered in compact masses."

In a work published at Rome in

1651 by Vitalis Mascardi is a figure of a double-flowered dahlia which has until recently been regarded as an evidence that at this early date cultivation by florists had resulted in this change from the single to the double type. No further record of the plant is to be found until 1787, when a Frenchman, Nicholas Joseph Thiery de Menonville, was sent to America for the cochineal bug. He speaks of dahlias seen in a garden near Guaxaca which had large aster-like flowers, stems as tall as a man, and "leaves like those of the elder tree."

In 1789 the director of the botanical garden at Mexico sent seed to the Royal Gardens at Madrid. The Marchioness (of Bute) obtained some of these seed and cultivated the plants in her English greenhouse. While not particularly successful she disseminated seed to various correspondents, including most of the botanical gardens in Europe. By 1803, an English nurseryman, John Fraser of Sloane Square, had

First figure of the dahlia ever printed, from the "Nova Plantarum Animalium Mineralium Mexicanorum Historia" of Francisco Hernandez, 1615.

flowered *Dahlia coccinea* (a single form) in his greenhouse, and this plant was the subject of the first picture to be printed in England, appearing in the "Botanical Magazine" in 1804.

The director of the Madrid garden, Abbé Cavanilles, named the plant, seed of which was sent from Mexico, in honor of André Dahl, a Swedish botanist. Cavanilles recognized two species, *Dahlia pinnata* and *D. coccinea*. The seedlings from *D. pinnata* were so various that it was renamed *D. variabilis*, but according to the rules of nomenclature the latter name cannot stand. The same can be said of *D. rosea*, which is simply a synonym of *D. pinnata*. The many varieties of dahlias with rounded compact heads, looking so artificial, are descended from this species. *D. cocinea* does not cross with other species and retains the simple habit. The color varies from scarlet to yellow or brownish red, never verging on pink or crimson.

About 1863 there was sent to Europe from some unknown locality in Mexico a single hybrid plant growing in cultivation, afterward named *Dahlia juarezii*, which was the origin of all the varieties now known as cactus dahlias or hybrid cactus dahlias. It bloomed for the first time in 1864 and was figured in the "Gardeners' Chronicle" in 1879. It was not until October 21, 1916, however, that the ancestral wild form of *D. juarezii* was discovered by Wilson Popenoe in Guatemala. This proved to have a single row of eight long spreading crimson rays turning backward along the margin, and was named by Safford *D. popenovii*.

By 1814, the dahlia was established in England and France, and Erfurt and Leipzig, in Germany, and the Hague, in Holland, were noted centers for its cultivation. The "Annual Dahlia Register," one of the first publications of its kind, appeared in 1836, and we find it filled with advertisements of dealers in dahlias, the prices per plant ranging from five to twenty-one shillings.

As we now know, double forms of the dahlia were well known to the Aztecs who domesticated the wild dahlias of the mountains of Mexico and Guatemala before the discovery of America. It was not until 1814, however, that a double variety was obtained by Donkelaar at Louvain, and as has been said, it is generally believed that the double dahlia is the result of modern selection and cultivation.

The original wild species, *D. pinnata*, gave rise to the so-called "show" or ball-shaped formal flowers. From this there was developed in France the "fancy" type. The "decorative" dahlia is believed to be the result of a cross between the "show" and "cactus" varieties, differing chiefly from the typical "cactus" in its strength and more profuse blooming. The "pompon" or "bouquet" type is of German origin, dating back to 1808, when Hartweg obtained it from the single-flowered *D. coccinea*.

It is extremely difficult to trace correctly the introduction and development of the dahlia in America. Apparently, however, it was not many years after the culture of this plant was established in England that a few growers on the Atlantic coast began to

FIG. 66.—DAHLIA YUAREZII: CRIMSON. (SEE P. 433.)

Dahlia yuarezii: crimson. Gardeners' Chronicle, Oct. 4, 1879. p. 433.

experiment with it. The first book and probably one of the very first publications on the dahlia in the United States was by E. Sayers. This was printed in Boston in 1839 under the title "Treatise on the Culture of the Dahlia and Cactus." (available in the Garden library) . . . Seedsmen's catalogues about 1860 began to publish lists of dahlias.

The first American Dahlia Society, which is not to be confused with the existing American Dahlia Society, founded in 1916, was organized at the Hotel Hanover, Philadelphia, March 20, 1895.

—from THE MISSOURI BOTANICAL GARDEN BULLETIN. September, 1929. Vol. XVII, No. 7

In the middle nineteenth century the show dahlia, or ball type as it is now called, was the most popular variety. The introduction of *Dahlia juarezii* reawakened interest which had lessened during the 1860's, and in the 1880's the small varieties enjoyed a season of popularity.

Since then interest in dahlias has grown steadily, not only in the United States, but all over the world. Dahlias are available in practically every color except pure blue; and in sizes varying from pompons less than an inch in diameter to giants as large as 14 or 15 inches across. More than a dozen distinct forms are recognized, occurring in nearly every size classification. Today's favorites are truly cosmopolitan, ranging from American varieties such as "Mrs. Hester A. Pape," "Ceramic Beauty," and "Surprise," to the Coreydon varieties from Australia, "Mushashi" and many others from Japan, the incomparable dark red cactus "Juanita" from South Africa, Ballego's many introductions from Holland, and thousands of others from Germany, Italy, Czechoslovakia, France and England.

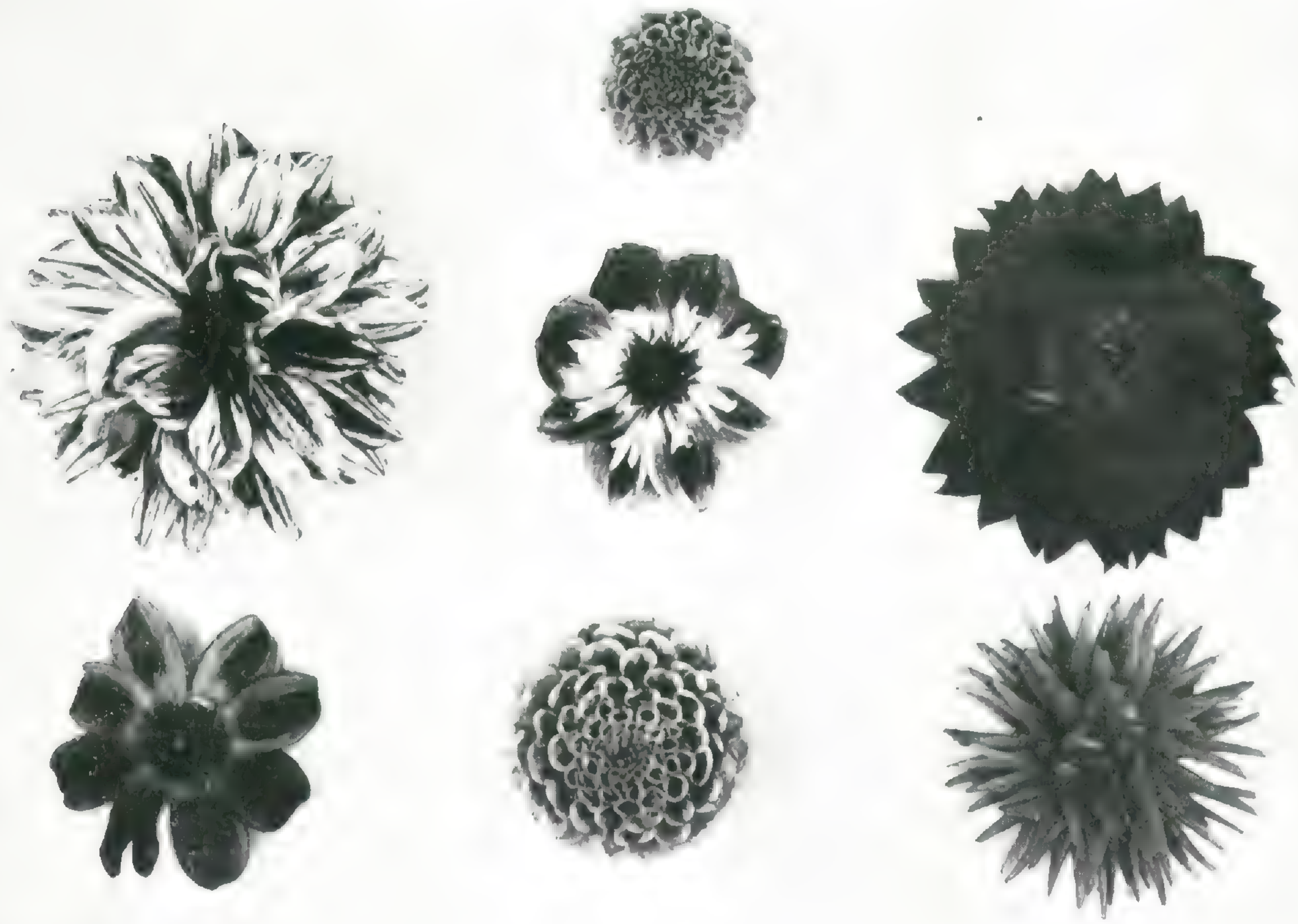
As dahlia popularity has grown, so have the dahlia clubs and societies. Some are subdivisions of general gardening clubs, others specialize in dahlias alone. Many are regional or statewide in membership. The American Dahlia Society has members all over the United States, working together to exchange cultural information so that all might improve their growing methods.

The St. Louis Dahlia Society was organized February 11, 1939, with Mr. Ed Nolte serving as the first president. Through the years the membership has grown, and the fall show, usually held the last weekend in September, has always been one of the most popular attractions of the year at the Missouri Botanical Garden.

TYPE CLASSIFICATION OF EXHIBITION DAHLIAS

Dahlias are composite flowers belonging to the Family Compositae or the Sunflower Family. In this family the flowers which make up the head (a single bloom) may be of all one kind, either strap-like ray flowers or tubular disc flowers; of two kinds, usually disc flowers surrounded by ray flowers; or of combinations involving various modifications of disc and ray flowers.

The various forms of the Dahlia have been classified for the benefit of growers and exhibitors by the Joint Classification Committee consisting of



DAHLIA TYPES

Peony
Single

Pompon
Collarette
Miniature Formal Decorative

Informal Decorative
Cactus

five members from the American Dahlia Society and five from the Central States Dahlia Society.

The size divisions are: "A"—large, over eight inches in diameter; "B"—medium, six to eight inches in diameter; "BB"—intermediate, four to six inches in diameter; "M"—miniature, under four inches in diameter. Exceptions to these groups are the pompons, which must be under two inches; and the miniature ball dahlias, two to four inches in diameter.

Single Dahlias: Open-centered flowers, with only one row of ray florets (a floret is a small flower), with margins flat or nearly so, regardless of the number of florets. For example: "Candlelight."

Orchid-flowering Dahlias: Flowers as in Single Dahlias excepting that the rays are more or less tubular by the involution of the margins. "Dahliadel Twinkle."

Collarette Dahlias: Open-centered flowers, with only one row of ray florets, with the addition of one or more rows of *petaloids*,* usually of a different color, forming a collar around the disc. "Erica."

* Modified ray florets (?). (A distinction made by the Joint Classification Committee but not clearly defined, italics mine, Ed.)

Anemone Dahlias: Open-centered flowers, with only one row of ray florets, regardless of form or number of the florets, with the tubular disc florets elongated, forming a pincushion effect. "Vera Higgins."

Peony Dahlias: Open-centered flowers with two to five rows of ray florets with or without the addition of smaller curled or twisted *floral rays** around the disc. "Pink Lassie."

Incurved Cactus Dahlias: Fully double flowers, with the margins of the majority of the floral rays fully revolute for one-half or more of their length and the tips of the rays curving toward the center of the flower. "Oakleigh Champion."

Straight Cactus Dahlias: Fully double flowers, with the margins of the majority of the floral rays fully revolute for one-half their length or more, the rays being straight, slightly incurved or recurved. "Edna D."

Semi-Cactus Dahlias: Fully double flowers, with the margins of the majority of the floral rays fully revolute for less than half their length and the rays broad below. "The Cardinal."

Formal Decorative Dahlias: Fully double flowers, with the margins of the floral rays slightly or not at all revolute, the rays generally broad, either pointed or rounded at tips, with outer rays tending to recurve and central rays tending to be cupped; and the majority of all floral rays in a regular arrangement. "Five Star General."

Informal Decorative Dahlias: Fully double flowers, with the margins of the majority of the floral rays slightly or not at all revolute, the rays generally long, twisted or pointed and usually irregular in arrangement. "Glamour."

Ball Dahlias: Fully double flowers, ball shaped or slightly flattened, floral rays blunt or round at tips and quilled or with margins involute for more than half the length of the ray in spiral arrangement, the flowers 4 inches or more in diameter. "Alice J."

Miniature Dahlias: All dahlias which normally produce flowers that do not exceed four inches in diameter, pompons excluded, to be classified according to the foregoing descriptions.

Pompon Dahlias: Having same characteristics as Ball Dahlias but, for show purposes, not more than two inches in diameter. "Little Edith."

Dwarf Dahlias: Term that applies to plant size without regard to the characteristics of the blooms.

There were fifteen color divisions listed in the 1953 classification list; the colors ranging from white through yellows, reds, and purples, in combinations, blends, and variegations.

—from the 1953 Classification of Dahlias

DAHLIA PROPAGATION

Root Divisions

"Dahlias are most commonly reproduced by dividing the clumps of tuberous roots in March or April. You can usually see buds or "eyes" on the crowns at this time. If not, place the clumps in a warm, moist room for several days to make the buds show up. Then separate the clumps with a sharp knife into sections with one bud and one or two roots each. Discard damaged roots and those without buds."

After danger of frost is over, set the tuberous roots 4 to 6 inches deep, depending on the soil type. Use the deeper planting on light sandy soils, and the shallow planting on heavy clay soils.

—University of Wisconsin,
Extension Service

"For the amateur, clumps are better partially divided in January or February. Trim out any portions of crown or roots that show decay. On early dividing it is not advisable to cut apart to single root divisions, but rather divide a clump into two to four pieces, leaving two or more roots to a division. These can be again divided at planting time as long as you have one good eye with each root. Dip cut portions in Dahliadel Dip and repack as before. When dividing clumps, tagging each division becomes quite a chore, also these tags must be removed before planting. It is therefore less work to wet the root with a sponge or rag and mark either name or number right on the root with an indelible pencil. This will not come off when packed in vermiculite or even during a growing season in the ground. Let roots dry in air before repacking in vermiculite."

—Warren W. Maytrott in Dahliadel

I take clumps of roots out of storage about April 15th and after dividing them start the buds in a cold frame covered with a good-fitting sash. Gently slope the soil in the coldframe and place a plastic cloth on it. Then place the root sections close together in a horizontal position and cover with about three inches of sand. As soon as shoots appear, move sections to another identical frame and space three or four inches apart. Let the shoots grow to five or six inches in height before planting them in the garden. While in the cold frame, plants should be sprayed with insecticide and liquid fertilizer at about 10-day or 2-week intervals. Keep the cover on only when the temperature drops below 45°, or to keep out excessive moisture; however, the sand must be kept moist. The plastic cloth keeps the roots from growing into the ground and induces them to fan out as you would like to find them when you dig up the roots at the end of the season.

Cuttings

Sooner or later the real dahlia enthusiast becomes interested in increasing the number of plants of a variety that he particularly likes. A root clump usually gives from three to five divisions with good, live buds; but the exhibition grower who wins ribbons for "best vase of ten or fifteen blooms, same variety" must have not less than ten plants from which to choose those blooms. To obtain more plants than root divisions will give, the grower resorts to cuttings (that is, the successive cuttings of the sprouts that grow from the buds on the tubers), which after being rooted, are potted up, providing growing green plants for setting out in the field or garden.

This additional increase is not the only reason for growing plants from cuttings. The use of cuttings makes it possible to plant the patch with young plants of uniform size, which makes timing for the show much easier. Also it has been the experience of many growers that good green

plants will start off much more vigorously than plants from roots, and are much less subject to the dwarfed or stunted condition sometimes found in plants grown from root divisions. Moreover, it is possible for the commercial grower to offer green plants of new varieties at about half the price of root divisions.

"Dahlias can be multiplied quickly by cuttings taken in late winter. To develop cuttings, plant roots indoors in large containers or in a greenhouse bench in January. Place the crown just below the surface of the soil. Use a soil containing one part each of sandy soil, peat moss, and sphagnum moss. Provide full sunlight and maintain a 60° temperature.

"As soon as the third set of leaves has developed, cut off the shoots at the soil surface. Place these cuttings in coarse sand or vermiculite, and leave them until they form roots—about 3 to 4 weeks. Place them in a shaded location and keep the sand or vermiculite uniformly moist. If the plants become too large for their containers prior to setting outdoors, transplant them to a larger pot."

—University of Wisconsin,
Extension Service

In a Home Window: Enough dahlia plants for the average garden can be easily grown from cuttings in a sunny window at home. A southeastern exposure will provide the essential sunshine. Four boxes, two of them 8 inches deep for the roots and the other two 4 inches deep for the cuttings, should be made to fit the space to be used. It is well to keep the size of the boxes small enough to be handled easily, since a large container when filled with roots or cuttings in moist sand or peat moss would be too heavy to move easily to the work bench. Place boxes on a sturdy bench or table at sill level in front of the window. Since the bench and boxes will be a part of your living room furniture for a few months it is best to provide neat and well-made equipment.

The production of shoots and rooted cuttings will be fast at normal room temperature and therefore it will be unnecessary to start the roots before the last week of February. It will be necessary to have enough good cold-frame space available to care for early plants. Select firm, small- to medium-sized roots if possible (large roots use much space without producing any more cuttings). Insert roots vertically into damp peat moss in the deep boxes, leaving the crown at or slightly above the level of the moss. Label each root or group as planted. Pack the peat moss firmly and water thoroughly, allowing excess water to drain through the boxes before placing them in position in front of window. Fifty or more different varieties can be started in two boxes 12 × 22 inches. In about two weeks shoots will appear on the crowns of the roots. When these shoots are about two inches high they should be cut off leaving a trace of the new growth attached to the crown. New shoots will then form around the old one and these may then be broken off without damage to the eye. Insert cuttings about 1 inch deep in the shallow boxes which have been filled with a mixture of ½ sharp sand

and ½ peat moss by volume. 100% sand is good as a rooting medium but the peat moss keeps down the weight of the filled container making it easier to handle and it is just as good as sand.

Mark cuttings with a label, pack the sand and peat moss firmly about the stem and then water thoroughly. The boxes containing the cuttings should be placed nearest to the window to get the most sunlight. In about ten days or two weeks roots will have formed on most varieties. These can be removed carefully and potted in 3½- or 4-inch pots using good loose potting soil. Keep partially shaded for three or four days until established and then place in a cold frame until time to plant in the garden. Keep the young plants cool, but free from frost, well ventilated and in as much sunlight as possible. It is very important that the root stock and the cuttings be kept moist at all times. Liquid fertilizer applied weekly to the peat moss around the roots will help to keep the later cuttings as strong and healthy as the first ones. Several hundred young plants can be propagated in this manner without too much mess in the home if reasonable care is exercised in watering and handling the boxes.

In a Garage: The patio portion of my garage is 6 × 16 feet and has a wall on the south and west the lower portion of which is concrete blocks (four blocks high) and the upper portion common window sash. Benches were constructed using corrugated transite for the beds and flat strips of transite six inches high for the sides, assembled with aluminum strips, bolts and nuts. The legs are concrete blocks. A thermostatically controlled heater is used during the cool weather to maintain a minimum temperature of 55°. The two windows on the south end are kept open as often as possible. Fresh air and sunshine are believed to be the controlling factors resulting in a loss of less than one percent of the cuttings during the past season.

A three-inch base of damp sphagnum moss was laid on a section of the bench having a southern exposure. Here the roots were placed and packed with additional damp sphagnum, leaving a sufficient amount of the root crown exposed to enable easy removal of cuttings. The sphagnum should be kept moist. Shoots will begin to appear on the roots after about ten days.

The section of the bench employed for cuttings contains a base of 1½ inches of torpedo gravel with four inches of coarse, clean sand on top. Drainage, so important to the cuttings, is almost perfect, since moisture settles to the gravel and runs out the end of the bench. Cuttings should be dipped in a hormone powder, such as Rootone, and placed in the sand an inch to an inch and a half deep. Water thoroughly. If cuttings wilt the first day or two some shade should be provided. Cuttings should root in 10 to 30 days. Transplant in 4-inch pots or 3-inch bands. A potting soil consisting of one part black or neutral peat moss, one part dried cow manure, one-half part sand, and three parts garden loam has been the most successful mixture I have used. When potted and watered, the rooted cuttings are placed in a shaded area for 24

hours and then put into the cold frame.

Some points that should be kept in mind—roots, cuttings and plants should always be watered thoroughly but never left standing in water; ventilation is a necessity; propagating should be on the cool side for strong firm growth. Keep the area clean, as a cluttered dirty area provides an excellent place for disease and insects to breed. Lastly, do not neglect your cuttings—a check in their growth could ruin all chances of a strong healthy dahlia plant.

In a Greenhouse: Our greenhouse, which measures 6 × 12 feet, is fastened to the house and is heated by raising the windows leading into the house. For propagating the dahlias we use boxes 10 × 16 × 4 inches—a size easily moved from the greenhouse shelf to the potting bench. Roots with definite buds "eyes" are always used; this eliminiates wasted space with blind roots. They are placed in moist pure peat moss which is soft, easy to handle and light to lift. Cuttings are made when shoots are two and a half to three inches long. Smaller shoots will root faster than big ones that are sometimes hollow. The first shoot from a bud is cut off with a sharp knife; the later shoots can be "wiggled" and broken off.

A sprout being "wiggled" or broken off.

We use a good, clean, sharp sand in which to place cuttings to root. We have tried rooting hormones but have discontinued using them because we prefer two or three good husky plump roots or root "knobs" on the cutting rather than the mass of fine hairy roots produced on treated cuttings. Two or three roots at the start make a better root clump to harvest in the fall. Thoroughly soak the sand in the bench and with an ordinary lead pencil, flat end down, make 1½-inch deep holes in the sand. Carefully *bottom* the cuttings in the holes and then firm the sand around them. It is essential to put the cuttings into the sand as soon as possible after they are cut. Although cuttings root faster with bottom heat, they also grow faster and get "leggy" much more quickly. Without bottom heat the cuttings form roots in two to three weeks ("Freda Gaylord" takes longer) and are short, stocky, and dark green. Watering the foliage and sand each morning with warm water as the temperature is rising is most important.

Placing cutting in sand for rooting.

Never water tender cuttings with cold water, especially when the temperature is dropping. We keep a tank filled with tap water to warm to room temperature for use in watering. Once a week the cuttings are watered with liquid fertilizer which is made up a little more dilute than the instructions recommend and mixed in the water warming tank.

New, green leaves are a positive indication that roots or at least root "knobs" have formed. We mention root knobs because we are sure that most growers have pulled a cutting from the sand and noted that instead of roots only little bumps or knobs had formed near the base of the cutting. We pot these because they keep right on growing in the potting soil and actually make a better formed root. Sometimes a cutting will be overlooked in the sand and finally when it is found and removed it will have roots several inches long. These long roots are very hard to transplant and we believe they tend to make poorly formed root clumps in the fall. Further proof that cuttings have rooted may be had by gently grasping the cutting and giving it a tug. If it seems to hold fast to the sand we know it is ready to take out and transplant to 3 × 3 × 3 in. plant band. We use nutrient treated bands that are uniform in size and fit together when placed in the cold frame, conserving space and moisture. Each tray holds 16 banded plants and has 16 holes drilled in the bottom to allow drainage for each plant. Ordinary garden soil is used in the bands. The soil is firmed around the rooted cutting carefully and watered heavily. After the first heavy watering the plants are grown on the dry side. The drier the soil the easier it is to handle individual plants. Too loose or porous soil will shatter from

the band; ordinary soil when dry forms a solid block.

We've found that these tender plants need a few days protection so they can recover from the shock of transplanting before they are moved to the cold frame. The transplanted cuttings are placed under fluorescent lights beneath the sand bench for 2–3 days then moved to the coldframe. We use unheated cold frames and nearly every year are forced to string long extension cords and light bulbs to the frame to keep the temperature just above 32 degrees. We do not shade; and we keep the covers off the cold frames as much as possible. Plants hardened off in this manner never show signs of shock or wilting when they are transplanted to the garden.

Last season our little "poor man's" greenhouse rewarded us with 1500 fine plants. We heartily recommend a small greenhouse to all gardeners.

Under Fluorescent Light: I have my propagating bench in the basement where the temperature is around 50 to 55°. The bench is 30 × 96 × 4 inches, and is 38 inches off the floor, built of 2 × 4's on angle iron legs. In the bottom of the bench is a heating cable connected to a bulb thermostat which is set as 60°. Above the bench are two 48-inch fluorescent lights each with two 40-watt bulbs (the type you can easily buy around buildings that are being remodeled or from electrical contractors). The lights are suspended by chains running through pulleys and counterbalanced with sash weights so they may be easily raised and lowered. A mixture of soil, sand, and peat moss in equal parts by volume is placed in the bench. Here the roots are placed leaving the crown well above the soil to make it easy for taking off the cuttings.

We start our roots in February because there will always be some that are very dry compared to others and much more time will be required for them to bud out. We find the ideal planting time in this area to be about May 15 and we always have nice plants ready by that time.

A method of propagating dahlias by cuttings under fluorescent lights which I have found very satisfactory is that suggested by the Grow Quick Sales

Company for the propagation of African violets.

Build a bench 5 × 2 feet with four shelves about 14 inches apart. Under each of the three upper shelves, place two fluorescent 40-watt lamps. On the bottom shelf place a heating cable. The bottom shelf is used for the roots which are placed in a mixture of about three-fourths peat moss and one-fourth good top soil and a little well-rotted cow manure. The cuttings are placed on the shelf above in pans containing 2 inches of small gravel and 2 inches of Meremac sand. After cuttings have rooted (from two to five weeks) they are put in 4-inch pots, left under the lights for another two weeks on the upper two shelves and then set out in the yard in a coldframe to harden off.

In order to control the lights and heat, I used a cable with a thermostatic control and a clock which turned the lights on and off automatically. I found that light from noon to midnight was sufficient.

Seed

One of the most interesting phases of dahlia growing is the raising of plants from seed taken from exhibition varieties. This seed can be purchased from nurseries that specialize in dahlias. Most of it is harvested in California where the climate is ideal for the production of seed.

Much of the fascination of growing seedling dahlias is the anticipation while watching them develop of viewing the first bloom. Since the varieties do not reproduce true to type from seed, each seedling plant grown will be different even though the seeds all come from the same flower head. All of the new varieties seen on the exhibition tables each year were once seedlings with the rare exception of those that developed as sports on another variety. Thus each seedling grown is a potential new champion—although the odds have been figured at approximately 1,000 to 1 against any one seed producing such an outstanding plant. However, the possibility is always there to add interest and suspense to the season.

In the vicinity of St. Louis, dahlia seed should be started indoors around the middle of March. A heated sunporch or a sunny window make suitable locations if no greenhouse is available. The seed can be sown in small flats of any size convenient to handle. They should have a depth of approximately three to four inches. A mixture of two parts soil to one part each of peat and sand should be used for planting the seed. No fertilizer is needed as the seedlings remain in the flat only a short time after germinating. The planting mixture should be sterilized for best results. A simple way to accomplish this is to put the mixture in an old dishpan or pot and heat in the oven for one hour at 250°. This treatment kills harmful organisms and any weed seeds that may be present.

When the sterilized soil has cooled, fill the flats and pack firmly with a block of wood. Place another quarter-inch of soil over this, level it, but do not pack. Make rows for the seed by pressing the edge of a pot label or a rule into the surface, making shallow depressions 1½ to 2 inches apart. Sow the seed about 1½ inches apart within

the rows. The seed is then covered, preferably with a thin layer of vermiculite or finely sieved sphagnum moss to avoid surface caking. The soil is then gently watered with a fine sprinkler to avoid washing out the seed. A covering of several thicknesses of newspaper or a pane of glass over the flat will help to retain moisture until the seed has germinated. A temperature range of 65 to 75 degrees should promote rapid germination. Examine the flats daily to be sure they do not dry out. When the seedlings begin to break through the surface, usually in four to five days, the covering of glass or newspapers must be removed and the flats placed where they will get plenty of sunlight.

When the seedlings have developed their first set of true leaves they can be transplanted. If placed into 3½- or 4-inch pots or plant bands they can be left there until ready to be planted in the field. After transplanting the plants should be kept out of the direct sunlight for two or three days, and then placed out in a coldframe. If kept inside too long the plants tend to get tall and spindling. Plants can be placed outside under a tree or near the wall of a house if no coldframe is available. When frost is predicted they must, of course, be brought inside since they can not be covered as if in a coldframe.

The dahlia seedlings are ready for field planting as soon as danger of frost is past. Sometime around the middle of May is a good time for planting out in the vicinity of St. Louis. Once in the garden they should be handled the same as any other dahlia plant. Be especially careful to spray them regularly; many a promising seedling has become infected with disease in its first year through carelessness in this respect.

Watching the seedlings grow and develop through the season is full of interesting surprises; and, when the buds begin to form, the anticipation and expectation makes daily inspection a must! If you want a new thrill from growing dahlias, try some seedlings.

DAHLIAS AS GARDEN FLOWERS AND BORDER PLANTS

Dahlias are among the most popular of show flowers in America. They ask for comparison and fear no competition. Maybe this is one reason why so many people neglect to grow dahlias as garden flowers. Only a few of our public parks display large borders and plantings of dahlias. It is my belief that gardeners of such institutions should be encouraged to plant more and more dahlias.

Modern dahlias are for modern people—for busy people who have little time for gardening, but who appreciate a fine show of color in their home garden. A bed or border of small-type dahlias costs very little and is no trouble to grow. During the warm months of the year these small beauties will produce a fine show of flowers that are remarkably free from disease.

Few garden subjects look better in the mass formation and the lucky gardener who has a fairly large plot can have bold drifts of color in beds and borders of just about every color except blue.

By using the dwarf types "Bonny

Otto Bergerhoff Gardens, Cologne, Germany.

Esperance," "Kokette," and "Snow White," along with the giants, a person can arrange a border with three bands of plants—tall at the back, medium in the middle and dwarfs in the front. Don't place them in definite rows like soldiers, but, taking care that the miniatures are not hidden, vary the arrangement by slipping in a tall variety here and there. A border with a waved edge is much more attractive.

Unless we dahlia-lovers promote our "first love" by planting borders, our neighbors may go on for years being dissatisfied with their gardens. No single garden improvement can equal a really large planting of bedder type dahlias. Nothing can add more brightness and beauty to an ordinary home garden, nothing else will give such lavish color, such commanding beauty for so little trouble.

With all the varieties of dahlias now available to the home gardener, the dullest most ordinary type of garden can be made into something that will be the envy of your neighbors.

A great number of people are not happy with their gardens and this isn't surprising because most of us started with limited experience when it was hard to visualize the plants and colors we really wanted. After a season or so the new gardener realizes he wants something more than just a trim lawn. It is at this point we dahlia lovers should convince our neighbors that dahlias are also the answer for bedder flowers even though the general opinion of most people is that dahlias are mainly grown for exhibition.

Bedder type dahlias can be bought as seed roots or green plants; all three types produce good plants in the home garden.

PLANTING

Plant dahlias where they will receive lots of sunlight. They do well in a variety of fertile, well-drained soils, but be careful to choose locations that protect the plants from wind damage.

Spacing depends on the varieties you have. Use a 3 × 4 foot spacing for larger varieties and a 2 × 3 foot interval for smaller ones.

Planting time in the St. Louis area is about the middle of May (exhibition dahlias need not be planted until the first part of June). Tuberous roots planted directly in the soil can be put in after danger of frost is over.

For Exhibition: Dahlias planted specifically for exhibition rather than for decorative purposes require more space for each bush; and planting is usually done somewhat later to reduce the amount of pinching and pruning necessary.

An easy rule to follow in spacing show dahlias is to allow six square feet of ground area for the plant and 1 bloom, and 2 square feet additional for each extra bloom on "A" size flowers, thus plants expected to produce 4 large blooms should be spaced at least 3 feet × 4 feet apart. This same area should produce twice as many "B" size blooms of exhibition quality and size. If your plants are close together do not allow as many canes to form if you want extra size and long stems.

Since most exhibition growers set out green plants, the proper planting time for St. Louis and vicinity is between the first and fifteenth of June. Exceptionally early blooming varieties should be planted a little later and very late varieties should be set out earlier to allow at least 2 or 3 weeks in the garden before pinching, as stated in the article on timing. If planting from dormant roots, start about 2 weeks earlier, and if using sprouted roots, about 1 week earlier than green plants.

For display flowers where the development of good root stock for next year's planting is not important do not plant more than 4 inches deep, as dahlias are surface feeders. Fertilize 1½ times as heavy as ordinarily recommended and irrigate extensively. Each cane should be carefully tied to a stake to insure long straight stems with good foliage that has not been damaged by being whipped about or rubbed against neighboring canes. For exhibition purposes perfect individual canes and blooms are more important than an overall pleasing garden effect. A good mulch applied in July will help to hold moisture in the soil and control weeds.

FERTILIZING

Natural Fertilizers: Dahlias like plenty of organic matter in the soil. I like to rototill compost or other organic matter such as old straw or grass clippings into the patch in the fall, along with a little rock phosphate or bone meal and some wood ashes. In the spring I rototill again some time before planting and let ground stand, then rototill once more at planting time.

At planting time I use a handful of tobacco dust around each plant. After plants are well started I take a small quantity of rotted manure and place it

in a five gallon bucket of water, let stand a few days then give each plant about a pint of this solution. Later repeat this once or twice before blooming time.

As soon as plants are tall enough mulch with compost, leaves, old straw or hay, or any suitable material to conserve moisture. Water once or twice a week and soak ground until it is really wet, and at the same time spray the underside of the leaves with a fine mist (this takes care of red spider mites).

Chemical Fertilizers: Of the elements essential for plant growth those needed in greater quantities than available in most soils are nitrogen, phosporus, and potassium. For dahlias the best proportion of these substances is 8–20–12; and if it is not commercially available it can be prepared by mixing 2 parts of 5–10–5, 4 parts 20 per cent super phosphate, and 1 part 60 per cent muriate of potash. Using one pound to 100 square feet put fertilizer into the soil in the fall or early winter and again in the spring about four weeks before planting time. Also in the spring four weeks before planting time put into the soil one pound of ammonium sulphate to 200 square feet of soil. Late in the summer a side dressing of the 8–20–12 fertilizer may be worked well into the soil about a foot away from each plant, then watered thoroughly.

If a liquid fertilizer is used start in the spring about two weeks after the plants have been established in the soil with a spray of 1 teaspoonful of 20–20–20 fertilizer to one gallon of water and apply about one quart per plant to the leaves once every week or ten days for the entire season.

STAKING AND PRUNING

All dahlias should be staked, especially if grown for exhibition. Staking is done to protect the plants from blowing over in storms, and also to keep the branches under control. Many varieties tend to grow in a widely spreading manner; to assure straight stems they must be closely tied to the stake. Stakes at least six feet long and one and a half inches square should be driven beside the hill to a depth of 12–18 inches. Cypress will outlast other woods for stakes but it is difficult to get at times and other woods treated with wood preservative are serviceable. Steel reinforcing rods or small diameter pipe cut to proper length can also be used and will last indefinitely.

The management of the growing plant is one of the most important factors in the production of top quality exhibition dahlia blooms. Such management begins at the time the plant has been in the field long enough to produce three or four sets of leaves. At this time the growing center of the plant is pinched out or cut off, just above the third set of leaves in the large "A" size dahlias, and above the fourth set of leaves for the medium "B" size. A short time after this is done a small lateral branch will begin to grow at the junction of each leaf and stem (the leaf axil). Thus the plant with three sets of leaves will develop six laterals and the one with four sets of leaves, eight laterals.

The two top laterals that develop on the "A" size plant are pinched out when very small so that it will develop only four branches. This is done to insure good sized blooms. Some growers reduce the amount of branches still further, but in good soil intelligently fertilized, a dahlia plant should easily produce four top-sized, good quality blooms for the show. The "B" size dahlias can be allowed six or eight branches since most varieties will attain sufficient size to win in their class.

It is important as the laterals develop to keep them trimmed of all excess growth. Some varieties tend to make many excess side branches; these must be removed and the plant kept to the four or six main stalks that we want it to have.

The first blooms of the dahlia are usually the largest so when growing for exhibition it is essential that all buds that form sooner than one month before the show be pinched out. When this is done one of the small laterals that develops at the next set of leaves below the bud is allowed to grow. It will produce the next set of buds, and if still too early the above procedure is repeated. Approximately thirty days (see Timing) before the show, pea-sized buds are allowed to develop for exhibition.

The above methods are not followed in the case of small varieties such as miniatures and poms, which are allowed to grow as many laterals as possible since profusion of blooms is wanted to keep them under the maximum size limit.

TIMING

"I had a better bloom than that blue ribbon winner in my garden last week," is a remark often made by viewers at Dahlia Shows. Last week's flower however, will never win a blue ribbon. The successful exhibitor knows that growing the prize-winning bloom is only part of the job—having it ready at showtime is an equally important part.

The goal in controlling flowering time is not, as many believe, to have practically every dahlia in the patch in full flower at showtime. This would be a difficult and risky thing to attempt since each season varies in rainfall, temperature changes, etc., all of which affect the length of time it takes a dahlia to bloom. The real goal in timing is to blanket the show date, allowing for the early, the normal and the late season. In this way a good proportion of blooms for the show is assured, regardless of the weather.

The method of timing most used in the Midwest is known as the "Double Pinch" or "Double Cutback". The first pinch is made when the young plant has three or four sets of leaves (as described above). The second pinch or cutback is made at a time determined by the date of the show. This time will vary depending on soil type and whether or not the patch is in full sun or part shade. In a dahlia patch in full sun a lateral will take fifty days after being cut back to mature a flower. This applies to most "A" size blooms—"B" size flowers especially of the cactus type will mature from five to seven days sooner. A patch that has part shade will require

55 or even 60 days to produce mature blooms from cutback. Experimentation is the only way to ascertain how to time the dahlias in your patch. Remember one thing—it is far better to cut back too soon than not soon enough. A plant cut back too early can still be made to produce blooms for the show by timing with the buds, but one cut back too late will not produce buds soon enough.

In order to blanket the show date as mentioned above, the following procedure is used. Assuming that timing is being tried for the first time, and remembering that it is better to cut back too early than too late, 55 days should be used as a cutback figure. First, take your calendar and count back 55 days from the date of the show. For example, if the show is on September 20 counting back 55 days gives July 27 as the day to cut back. Blanketing that date, five more days are counted back to July 22, and one cane from each plant in the patch is cut back on that day. Three days later another cane on each plant is cut back. Repeating this procedure twice more at three day intervals and the cutback on "A" size plants is completed. In the case of "B" size plants with six or eight laterals two canes are cut back each time. Cutting back in this way over a period of twelve days, there should be blooms for the show regardless of the weather.

The actual cutting back is accomplished with a sharp knife and a stout heart. A stout heart is needed to cut back four and five foot plants, yet they will rapidly send out new growth seemingly even more strongly than before.

The amount to cut off each plant depends on the preference of the grower. Some cut back almost to the ground, within one set of leaves of the main stalk. Others cut off just the upper two or three inches of the stem. If a plant four and a half to five and a half feet tall at blooming time is desired, cut off just enough of each stalk to leave the plant two and a half to three feet tall when cutting back is finished. Select a set of leaves on the stalk where the laterals are very small—no longer than one-half inch. Cut off the stalk at the set of leaves just above the one selected. If the cut is made directly through the node on most varieties the stem will be solid at that point and will not need to be capped. If the cut is made between sets of leaves, or if the plant is one of the few varieties that does not have a solid stem at the node, the hollow cut end should be capped with aluminum foil so that water does not collect in it. When the stalk has been cut back, any small laterals below the one selected for saving must be removed. Some of these laterals will not show up immediately and the patch must be gone over every few days to remove the unwanted laterals.

Five weeks before the show all canes should be examined for buds. Any in which the center bud is already pea size should have it pinched out and one of the side buds saved. This will delay blooming about five days and should hit close to the show date.

Plants showing buds the size of a small pea or a BB shot thirty days before the show are well timed. The two side buds should immediately be

removed to allow the center bud to develop. In the case of a "B" size dahlia the center bud should be pinched out and a side bud saved, since they usually open about five days sooner than "A" size dahlias.

All side laterals on the selected stalk should be removed while they are small to insure a nice clean stem for the show.

If the above directions are followed a good supply of blooms for the show should result.

PREPARING BLOOMS FOR THE SHOW

Preparing winning blooms for the show is not a last-minute operation, but rather begins even before planting. One must select varieties for planting that will have potentialities for fulfilling the requirements of the class or classes to be entered.

Show flowers should be well-grown, the foliage clean and unblemished, and the length of the stems in proportion to the size of the flowers. Timing the blooms to be at their peak at show time comes from experience. Some varieties mature in 25 days from a bud the size of a pea while others require 35 or more days. Some will continue to develop and hold up several days after they are in full bloom while others will sometimes drop their petals before the head is completely open.

Since dahlias are grown in the garden their development depends upon the weather and the moisture they receive during the finishing-off period previous to the show. Lack of moisture will retard the blooming; watering will speed up development. The use of dry chemical fertilizers is of no value in speeding up flowering during the last 30 days.

Cut blooms during the late afternoon or early morning. Remove the lower leaves, and the excess buds on the large varieties. Place the stems immediately in clean fresh water and set in a cool dark place until time to transport to show room.

Dahlias, especially the large varieties, are inclined to wilt after they are cut. The blooms are revived by either recutting the stems under water or by the use of the hot water treatment which is to place the stem in two inches of almost boiling water for two minutes, keeping blooms away from the steam. Following either method the blooms are placed in fresh cool water. I prefer the under water cutting to the hot water treatment. Care should be used in transporting the blooms to the show room.

POINTS FOR KEEPING CUT BLOOMS

Cut only fully matured blooms; those with a few withered petals will keep longer under similar conditions than young blooms. Cut a longer stem than will be necessary in the vase or final container. Make the cut with a sharp knife so that the microscopic tubes in the stem, which supply water to the flower head, are not crushed. Flowers should be cut at least eight hours before it is planned to use them. As soon after cutting as possible, the stems should be placed in cool water in a cool basement. When putting the flowers in water trim off an inch or two of the stem under water. This cuts off the portion of the stem into which air

may have entered the microscopic tubes and choked off the supply of water passing up to the flower head. After hardening or finishing in the basement, the flowers may be used for their intended purposes. Each time the stem is out of water for more than a moment, it should be retrimmed under water.

—From the Dahlia Blue Book for 1957

To ship dahlias pack hardened off blooms in a corrugated box lined with tissue or wax paper. Pack blooms in both ends of the box, face up, with stems toward the center. Fasten stems down by nailing a wooden strip in the center of the box or by tying down through the bottom.

—Warren W. Maytrott in Dahliadel

INSECT AND DISEASE CONTROL

What a glorious life we gardeners would have if there were no insects to keep us busy. We would grow fat and lazy and could just sit under the apple tree and relax and watch our dahlias grow into fine big healthy plants with beautiful blooms. Oh there would be a little cultivating to do and some disbudding, but we could let Slim do that, some friend who does not want to get fat. But alas, this is not the case. We do have our insects and diseases to keep us on our toes; yet thanks to our chemists we are able to combat most of these problems and have the beautiful flowers we strive for.

About the time of the second world war we were attacked by an invasion of pavement ants. There were many of us whose dahlias were just about wiped out. Then DDT became available and the ant troubles were over. We now have Chlordane which also does a good job of controlling ants. However with the introduction of DDT we began to have trouble with Red Spider, sometimes called the two spotted Spidermite. The red spiders had been held in check by predators and parasites until DDT and other chlorinated hydrocarbons destroyed these natural enemies without harming their prey.

Red Spiders are very small and as a rule cannot be seen without a magnifying glass. The body is oval, yellow, or greenish with two dark spots on the back. In some strains the adults are red. The mites make fine webs on the undersides of the leaves and if not checked the web may entirely cover the buds, or blooms. They suck the plant juices and must be hit by a contact spray. Malathion and insecticides that contain Aramite give good control. In warm weather the red spider will reach the adult stage in five days and will build up enormous populations in a short time. Most sprays will not destroy the eggs, so plants must be sprayed every five or six days for at least four times to get all the mites after they have hatched.

Aphids (plant lice) are small, soft bodied sucking insects usually found in clusters on leaves or buds. They are common carriers of mosaic virus disease. Treat with contact sprays such as malathion, Lindane, or Black Leaf 40. (Pyrethrum extract or rotenone are also recommended. One thorough spray will do the trick; but it must be repeated when the aphids appear again.

CUCUMBER BEETLES eat holes in the petals of the flowers. A dust containing a large percentage of DDT blown into the face of the bloom daily will keep this pest under control and save the petals from damage that would ruin the bloom for exhibition. A very light dusting will suffice; heavy applications will leave a residue which will detract from the beauty of the flower and cost points in the judging.

EUROPEAN CORN BORER, or the Stem Borer, is a serious pest to the dahlia grower. It winters in old stalks of dahlias, corn or weeds. In the spring for a period of three or four weeks the female moth lays her eggs on the underside of leaves. The larvae hatch out in early June and start eating their way down into the stalks. As they grow the bore enlarges weakening the stem which finally breaks. You can see where the borers have entered the stalk by the sawdust left at the opening. DDT will control these pests, but only before they get into the stalk. Start spraying for them about the middle of May. Many times the upper branches will start to drop before the borer gets too far down and if you can find the hole where it entered you may reach it with a thin soft wire. Some say they can see the borer by putting a strong light on the opposite side of the stalk. You can cut them out, or pierce them with a thin knife blade.

GRASSHOPPERS have spoiled many prize blooms. They can be controlled to some extent with Chlordane. DDT works so slowly that the grasshopper can damage the flower before dying. Grasshoppers can be discouraged by spraying or dusting a wide area around the dahlia plot.

LEAFHOPPERS are small greenish-yellow, flying insects that suck the sap from the leaves causing them to turn yellow; eventually the lower leaves die. These pests are also vectors of many virus diseases. They are hard to hit with a contact spray but DDT will control them.

LEAFMINERS are insect larvae which feed between the two surfaces of the leaf. They are almost impossible to control after they are in the leaf. Treat with Lindane or DDT when the eggs are hatching.

THE TARNISHED PLANT BUG is about ¼ inch long, brown, irregularly mottled with yellow and black splotches. The adults puncture the stems and buds causing small black spots. Plant growth is retarded and buds open one-sided. DDT is the best control for this insect.

THRIPS are very small insects frequently found in open flowers, although both leaves and buds may become distorted. Control with weekly spraying of DDT.

MILDEW may appear if the weather is hot and humid especially if the plants are close together with poor air circulation. Dusting sulphur, fermate or captan check mildew if used as soon as the first signs appear.

STUNT, if not due to poor culture, ravaging by insects or rotting of feed roots, is probably due to a virus. Mosaic virus which is carried by aphids causes the leaves to be small and slightly crinkled. Ring Spot virus usually shows up on the lower leaves in the form of a circular light green

pattern with zig-zag edges. Thrips carry this virus. Plants known to have virus should be destroyed; however if the plant is merely stunted give it another chance the next year.

A good contact spray and a good stomach poison spray, plus a good fungicide will keep your patch clean. One should have a separate spray for red spider and keep after them.

WINTER STORAGE OF TUBEROUS ROOTS

Successful storage of roots begins at the time of digging. As soon as frost kills the plants the stalks should be cut off near the ground, cutting on a slant in order that the moisture can drain. At this time the clumps should have labels tied to them for identification. The mulch and old stalks should be cleared away so that the stalk stump that is left will dry out. I like to leave the roots in the ground a while to finish maturing and to harden up, the length of time depending on the weather. Naturally they must be dug before the ground freezes but the longer they are left in the ground the less time they will have to be in storage.

To dig roots use a round pointed shovel, cutting into the soil in a circle about eight inches or so from the stalk. Remove enough soil so that a cut can be made under the clump allowing it to be lifted out. Cutting the roots free at the bottom prevents breaking the tuberous roots from the crown of the stalk. Remove what soil you can, but leave enough to cover or protect the roots. Temporarily store them where they will not freeze, placing the clumps on one side so the moisture will drain out of the stub of the stalk and let them dry out slowly.

Years ago I tried digging, shaking off the soil and letting the roots dry in the sun for a few days, but I lost most of them by spring. I believe this quick change is too sever a shock and does not allow the roots to harden up for winter storage.

In a week or two the soil around the roots should be fairly dry. I then place them on some boards, a window screen or plastic cloth in the garden and wash the soil off them with a stream of water from the garden hose. The clumps are then cut or sawed in half, or if quite large, quartered. At this time all sections are marked by dampening the roots and writing the name and the year grown on them with an indelible pencil. I also trim off the old roots, feeder roots and part of the stalk, then dust cuts with a mixture of ½ dusting sulphur and ½ talc. After drying for three or four days they are packed in buckets, cartons or boxes (I like a five gallon size.) in layers with vermiculite packing. I use no lids for I believe this helps the moisture to adjust itself. Each container may be tagged with a list of the varieties it contains. Place the containers five or six inches off the floor in a cool dry storage place so that they will not become damp. The average temperature of the storage place should be above freezing but no higher than 55 or 60 degrees.

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. spring to fall and until six in the winter time though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission twenty-five cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The step-in gate (more or less concealed by the big Cleveland Ave. gate, 2221 Tower Grove) is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi which are at their best in April.

MISSOURI BOTANICAL GARDEN BULLETIN

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GONE TO GRASSE

The home-bound European traveler, gloating over bargains in price and weight as he stuffs the corners of his luggage with perfumes, rarely suspects the difficulties they present as gifts. Does he know, for instance, that the scent, spicy and flattering to rich complexions, thus appropriate for a lady with an oily skin, will lose its flavor on a lady whose skin is dry and less pigmented? Has the simple tourist been warned that "a gentle, retiring woman must not use the same perfume as her headstrong excitable friend;" or that "the sportswoman will not perfume herself in the same way as the intellectual?" What American, male or female, appreciates that the active women of our world must change their perfumes many times a day, knowing that "a same perfume will not suffice . . . for a skin becoming golden in the sun, a skin emerging from the sea, (a skin) vibrant in the brilliance of a ballroom or softly relaxed in the shadow of a blossoming linden tree?" Bargain indeed! Rather than risk a wrong choice of scent the wise traveler will choose the alternate disaster of bulkier gifts and overweight.

Alas for Grasse; the books which made me so wise were purchased there, at Les Parfumeries Fragonard, and should have induced me to buy and buy and buy . . . perfumes. Instead, I bought only the books. One, *L'Amateur de Parfums*, by Victor Bayle, is the source of the above quotations; the other, *Langage Astrologique des Fleurs*, by M. L. Sondaz, is now the only perfumed volume in my library. It is imbued with a scent called "Belle de Nuit," appropriate, I suppose, to people who buy such books.

Mr. Sondaz' style is certainly appropriate to perfumery. I choose the following paragraph to quote because an interest in the tuberose induced my lateral approach to the perfume industry. "Certain very Venus-like women," Mr. Sondaz pontificates, "will choose the tuberose, whose pure white, so delicately touched with pink, and (whose) suave and voluptuous perfume evoke the sorcery of Selene. . . . The Greeks called it the flower of cities because it represented in the ancient world a refinement of cultivation. It ornamented the terraces of Ninevah, of Babylon, and of Persepolis. Its odor ravished the senses of Crœsus, of Semiramis, of Darius, of Alexander. . . . Lydian dancers in skillful or frenzied choreographies, priestesses of Astarte blended their seductions with the odor of tuberoses, whose

fragile blossoms formed a sweet and enervating shower."

When this book emerged from my luggage enveloped in "Belle de Nuit" I naturally deserted my microscope. But alas for Mr. Sondaz! His enthusiasms carried him too far in both space and time. The tuberose (*Polianthes tuberosa*), whose ancestry is not known, is generally thought by botanists to have originated in the highlands of Central or South America, and it was not introduced into Europe until the late 16th century. For more accurate, unscented, information I turned to Mr. Bayle.

Knowledge of the first use of perfumes, he writes, "is lost in the night of time." From the Latin *per fumum*, the word refers to fragrant fumes derived by combustion from resins and aromatic woods and barks. The technique was known long before the Roman period, however; Bayle suggests that the fumes were used by primitive peoples to counteract the less attractive odors caused by the combusion of sacrificial victims.

From this original utilitarianism the ups and downs of the perfume industry are traced by Mr Boyle to the significant date 1286, when "the corporation of master-glovers was recognized in Paris . . . (This is) a famous date in the history of French perfumery because it was between their hands (the glovers'!) that during several centuries the manufacture of perfumes would be concentrated" . . . despite constant wrangling with the haberdashers, who naturally wanted to get in on a good thing.

During the 16th century, at the instigation of the Medicis, the first perfume factory was established at Grasse, France, to manufacture perfumed gloves in the fashion of Spain and Italy. By the 19th century perfume-making had become such a big thing at Grasse that perfumers supplanted the weavers and tanners who had previously profited most from the natural advantages of the area.

For years it had been known that in the hills surrounding Grasse "the perfume of roses had a strength and a quality not to be found elsewhere." Now, "in less than a hundred years, the jasmines, tuberoses, roses and oranges of the country around Grasse have made of this little town a capital, that of the industry of materials fundamental to or destined for perfumes."

But alas, now, for the tuberose. "Flower with perfume charged," wails Mr. Boyle, "with nonchalance, the tuberose is dying, the tuberose is dead." Perhaps its scent is too sweet and enervating; perhaps today's ladies are less Venus-like. At any rate, the erstwhile annual harvest of 60,000 kilograms of blossoms in the area of Grasse has shrunk in recent years to 20–25,000 kilos. (A kilo is 2.2046 lbs.; a single tuberose blossom is 1½–2½ inches long, shaped like a trumpet, and a little over an inch across at the wide end. The tuberose may be dying, but can we say it's dead?)

Each plant produces from 20–32 blossoms, opening usually a pair at a time, from the base of the inflorescence toward its indeterminate apex. In the south of France tuberoses begin to bloom about the end of July; from then until the end of September very

early each morning the open blossoms are removed with sharp scissors and rushed to the perfume factories. By October 1st the scent begins to weaken, flowers are no longer gathered and, still according to Mr. Bayle, the tuberose becomes a drug on the markets around Grasse.

At the Fragonard factory and from Mr. Bayle I learned that the scent is extracted from the delicate tuberose, as well as from jasmine, by a very old process called *enfleurage*. (By this method a ton of flowers averagely yields 10–16 ounces of essential oil; therefore I was not surprised to learn recently from another source that *enfleurage* is no longer used by the larger producers). It consists of placing the blossoms on trays of purified pork and beef fat; the flowers are changed each 24 hours and the fat, after several months, is washed in alcohol at a temperature of 96 degrees C. The pure extracted essence obtained in this way is aged in a refrigerator for 10 months; in the case of the tuberose the fixative used with the oil is a small amount of ambergris and castoreum.

Enfin: we have the essential oil, but this is not yet what presents a problem to the tourist. The final product, perfume, blended often from combinations of animal, plant and synthetic scents, is a work of art indeed. There's one for every mood in any season at whatever hour of a busy day. Mr. Bayle lists 160 of them by name, and hints at dozens more. It's up to you to learn which best accords with a certain lady of a special temperment and a specific pigmentation—before you go to Grasse. —E.R.E.

THE DAWN REDWOOD

An Unusual Tree for St. Louis

The Dawn Redwood, *Metasequoia glyptostroboides*, has presented a variety of surprises for gardeners and botanists in the United States. It grows remarkably fast and it has proved to be hardy in selected spots as far north as Chicago and New England. This fall, the nine-year-old specimens behind the Shaw House (already over ten feet tall) turned a copper-brown, distinctly more coppery than the fall color of the Bald Cypress.

A tree of ancient lineage, the Dawn Redwood was first discovered in a remote region of China by Mr. T. Wang in 1945. It was previously known only from paleobotanic records but is now known to exist as a single living species in a very limited area and it or its geologic history dates back to Mesozoic times. These "living fossils" are large trees attaining the height of at least 115 feet with a trunk diameter of at least seven and a half feet in their native habitat.

The specimens of Dawn Redwood at the Garden were grown from seed obtained through the Arnold Arboretum from China. The trees present much the same general appearance as the Bald Cypress and, as in the Bald Cypress, the branchlets are deciduous. Local nurseries, realizing the promise of this interesting tree are now offering stock plants for sale. —E.L.E.

AN OFTEN OVERLOOKED GROUP OF HOUSEPLANTS

By HENRY KALTENTHALER

USUALLY when one thinks of houseplants one visualizes such plants as African Violets which require watering every day or two. Of course, there are the succulent plants which require less care, but even with these one must water them fairly frequently if he wishes to secure good growth or flowers. There is one habitat group of plants, though, which requires essentially no care and at the same time gives excellent results as unusual plants. These are the aquatic and semi-aquatic plants. For the purposes of this article we shall limit the use of the term aquatic to those plants which thrive only in a submerged environment or else in a floating situation. The semi-aquatics then shall constitute all of those plants which will tolerate a submerged condition but which do best when planted in not over an inch or so of water. Some will even grow to profusion if planted in pots which are set in water to within an inch of the top.

Perhaps the best known of all of the aquatics is none other than the Water Hyacinth (*Eichornia crassipes*) which becomes a noxious weed in a slightly more southerly location than St. Louis. However, this is actually one of the most difficult of all of the aquatics to keep in a healthy condition since it demands an exceedingly well-lighted location in order to maintain itself in the winter months. The submerged aquatics actually offer the greatest potentialities when it comes to the decoration of a room. Most will grow in any container with glass sides in a sunny location or in the center of the house if given sufficient artificial illumination. This container in which the plants are grown may vary from the dime store aquarium through battery jars, glass bricks and even to rectangular aquaria containing practically any volume of water from two to fifty gallons. The rectangular aquaria will usually cost in the neighborhood of one dollar per gallon volume and can be bought in most any pet store. These pet shops also usually carry a rather wide variety of aquatics and semi-aquatics which will do well in the home situation. The following is a partial list of plants which are rooted aquatics and which usually stay within bounds in the home environment.

Water Sprite (*Ceraptopteris thallictoides*)
Corkscrew val (*Val'isneria spiralis*)
Some Water Four-leaf Clovers (*Marsilea* spp.)
Madagascar Lace Plant (*Aponogeton fenestralis*)
Madagasgar Sword Plant (*Aponogeton undulatus*)
Various Arrowheads (*Sagittaria* spp.)
Various Burheads (*Echinodorus* spp.)
Hygrophila
Spike rush (*Eleocharis acicularis*)
Various species of Cryptocoryne

In addition to the aquatics which are rooted there are many which are either non-rooted (i.e. they are not anchored in the bottom of the tank) or else which form such long stems that, to all intents, they may be considered as non-rooted. In the former

group are the Duck Weeds (Lemna and Spirodela) and two very small floating ferns (Salvinia and Azolla) which form a dense mat on the surface of the water under favorable conditions. Other floating aquatics are Water Hyacinth, Water Lettuce (Pistia), and a floating form of Water Sprite, all of which form floating rosettes of leaves instead of mats. A third group of non-anchored aquatics are the truly non-rooted ones such as Lesser Bladderworts (*Utricularia minor*) and Hornwort (Ceratophyllum). Quite similar in habit to these last plants are the long-stemmed rooted plants of which the well-known Ditchwort (Elodea) and Fanwort (Cabomba) are typical examples.

By utilizing various of these plants in appropriately proportioned aquaria one can have beautifully landscaped (or, more correctly, aquascaped) scenes in the living room. If, after one has set up his aquarium and enjoyed it for several days, he may want to add to it by purchasing a few fish. Most of the fish available in pet shops will not harm the plants in any way and all of them aid the plants by supplying a small amount of fertilizer. Any pet shop proprietor will be happy to recommend fish which will be suitable for a given environment.

In many respects the most satisfactory of all of the plants for the home are the semi-aquatics which, because of their growth habit, can be grown in an opaque container. While few of these bloom in a showy manner, if at all, most have very attractive foliage. They require little in the way of care other than plenty of water in the region of the roots and plenty of light on the stems. Best of all, one frequently has suitable containers for them around the house so it is unnecessary to procure a special container. Water Milfoil (Myriophyllum), Papyrus (Cyperus), and some Water Four-leaf Clovers are typical examples of this group of plants.

WINTER BLOOMING SHRUBS AT THE GARDEN

By E. L. EVINGER

The witch-hazels, Autumn and Winter blooming ornamental shrubs of good garden character and habit can be seen growing and flowering at this time in the Garden. The flowers with four long narrow ribbon-like greenish-yellow petals almost cover the branches, now bare of leaves, reminding one of Forsythia. The "witch", probably allied to weak, refers to the drooping or straggling growth habit and the "hazel" to the general similarity to the true Hazels of the genus Corylus. The use of a distillate of the bark or the leaves of witch-hazel as a soothing counter-irritant for skin disorders dates back to Indian legend. Some hand lotions today contain "witch-hazel". The generic name Hamamelis refers to the habit of ripening the fruit of the previous season simultaneously with the flowers of the current season (Greek, *hama*, together, and *melon*, apple or fruit).

There are two native witch-hazels, *Hamamelis vernalis* and *Hamamelis virginiana*. Both may be seen in flower in the Garden now, though *H. vernalis*

usually blooms later in winter or in very early spring when in its native habitat. Two other species have been introduced from the Orient, *H. japonica* from Japan and *H. mollis* from central China. These likewise are very early-blooming, hardy shrubs. They have a touch of red or plurple, which is in the calyx, added to the usually yellow flowers.

The witch-hazels with their hardy excellent-growing form and autumn-winter flowering habit are a most promising genus of shrubs. Further development horticulturally can doubtless bring about more showy flowers for a time when the gardens are otherwise inactive.

Left:

Flowers of *Hamamelis virginiana.*

(Photo by Kenneth Peck)

EVENTS AT THE GARDEN

THE 1957 CHRYSANTHEMUM SHOW.

The Garden's annual Chrysanthemum Display opened November 7 in the Floral Display House and will continue throughout the month. This year the exhibition is designed by the firm of Kimio Obata and Associates and installed under the direction of Mr. Paul Kohl, the Garden's floriculturist.

The design retains the color and mass of the traditional fall shows but adds the new features of emphasizing individual plants and flowers. A traditional Japanese garden with waterlily pool, stone lantern and grotesque pine tree has been built at one end of the Display. At the opposite end of the large greenhouse is a mass of most of the many kinds of chrysanthemums grown at the Garden. Hanging overhead are the baskets of mums for which the Garden is famous.

On the balcony is a large collection of new and old varieties of chrysanthemums grown by the Chrysanthemum Society of St. Louis. Their flowers are arranged in a formal pattern defined by stones and iron benches.

The greenhouses at the Garden are open daily from 9 A. M. to 5 P. M. and there is no admission charge.

FOURTH SYSTEMATICS SYMPOSIUM.

Biologists from all over the United

States met at the Missouri Botanical Garden on Friday and Saturday, October 25 and 26, for the Fourth Annual Symposium on Systematics. Registration and a reception for the attendants was held Friday evening. On Saturday a number of papers given by invited speakers provided material for discussions by the entire group of more than 200 botanists and zoologists from various colleges, universities, and other research institutions.

The subject of this year's symposium was "Basic Concepts and Techniques in Systematics". Basically, systematics is the study of the classification of plants and animals. Originally largely concerned with distinguishing the different kinds of organisms and providing them with names (in which sense it is more or less synonymous with the term taxonomy), systematics has come to consider as well the relationships between various plants or animals and to set up a system exhibiting these relationships. Although systematics is not primarily concerned with evolution or genetics or ecology, these fields contribute evidence to the systematist. This annual symposium provides an opportunity for biologists to discuss problems in systematics, both botanical and zoological. This year the speakers discussed some of the fundamental ideas and methods used in developing systematics.

The meetings were under the joint chairmanship of Dr. Carl Epling and Dr. Ernst Mayr. Dr. Epling, professor of Botany at the University of California, received his degree in 1924 at the Henry Shaw School of Botany. Dr. Mayr, is Agassiz Professor of Zoology at Harvard University.

Dr. A. C. Smith of the National Science Foundation closed the meetings Saturday night with a talk on plant collecting in the Fiji Islands.

The symposium is supported by a grant from the National Science Foundation. Originally designed for scientists of the middlewest, the meetings have been so successful that they are attracting people from all over the United States. —G.V.S.

Holiday Historique.

The third annual fund-raising project of the Women's Committee was given November 1–3. Called "Holiday Historique" and subtitled "The Mayflower Comes to Shaw's Garden", this project featured ideas and decorations based on historical themes. A large-scale replica of the Mayflower, table decorations by various Garden Clubs, an Avenue of Ideas, entertainment, displays of ship models by Scout Groups, a bakery shop, and tables of refreshments were set up in the Display House and two adjacent greenhouses.

Chairman of the project was Mrs. Edwin R. Culver, Jr. Mrs. William J. Hedley and Mrs. T. Randolph Potter were co-chairmen. Admission for adults was one dollar, for children, fifty cents. Funds from previous projects have been used to make urgently needed repairs to the Shaw House, the Museum and Henry Shaw's town house, now used for offices and research laboratories. These repairs add greatly to the life expectancy of these useful and historic old buildings.—H.C.C.

SUGGESTIONS FOR LATE FALL GARDENING

FINISH fall plantings of trees and shrubs. Be sure a small dike of soil is left around planting hole. This is particularly necessary with evergreens for they may need watering (when soil is thawed) during prolonged dry spells in winter.

Late in November is a good time to go over rose bushes and cut back extra-long and vigorous canes. Long shoots on Hybrid Tea roses and other types, except rugosa and climbers, can be cut back to about two feet. Shortening branches decreases danger of strong winds working plants loose in soil when it is thawed.

Get burlap sacking or rush matting ready to cover cuttings and perennials over-wintering in coldframe, should temperature drop suddenly.

Late in November roses should be "hilled" with soil or other mulching material. Straw or coarse grass or juniper branches should be worked in among the rose tops to screen branches from winter sun. Never use materials that will mat or become soggy when wet. Roses will survive best if given plenty of air in the crown, yet protection from winter sun and sudden freezing and thawing.

Late November is a good time to rake oak leaves around Azaleas to provide some protection against winter sun and sudden temperature changes.

Before all the leaves have fallen from trees and shrubs make a mental note of branches that are dead and need to be removed—a job just as well left for a warm December or January day.

As soon as leaf-mulching chores are over for the rotary mower, clean it thoroughly. Remove blade for sharpening some winter night. Drain gas from tank and carburetor, remove and clean spark plug, squirt thin oil into cylinder through spark plug hole and crank several times, then replace spark plug. Clean air filter. Cover mower with plastic or other dust and moisture proof material.

Get in soil for repotting a few houseplants.

Load up bird feeders. —L.G.B.

BOOK REVIEW

Gardening, A New World for Children. By Sally Wright. 183 pp. The Macmillan Co., New York, 1957. Price $2.75.

THIS book is filled with ideas on how to keep children interested in plants and gardening; but almost anyone will enjoy reading it and will find many useful suggestions for hobbies. Here are ideas for extending garden activities throughout the year —from growing plants to preparing skeletons of leaves and collections of dried plants for study. The author is practical. Each suggestion is exciting enough to keep interest alive and the materials and methods are simple. At the end there is a suggested reading list, and a list, with addresses, of suppliers of seeds and plants mentioned in the text.

This book provides enough things to do to keep children, nature students, and gardeners profitably occupied for a long time. —H.C.C.

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Robert E. Woodson, Jr.....Senior Taxonomist

SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. spring to fall and until six in the winter time though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission twenty-five cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The step-in gate (more or less concealed by the big Cleveland Ave. gate, 2221 Tower Grove) is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi which are at their best in April.